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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

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The Double Star

POLARIS. The North Star. The Pole Star. A double star, "the duplicity of which" (the reference book says) "is difficult to see, on account of a wide difference in magnitude . . ." A confusing star evidently; and for sheer confusion the Polaris missile promises to turn out to be the mirror image of its heavenly namesake. Only in respect of technicalities—discussed by the technical editor in unprecedented detail last week and this—is America's newly proved weapon system clearly viewed. Strategically—which is politically—Polaris is giving rise to a murky new missile miasma in Parliamentary proceedings. Its adoption will, in the Prime Minister's words, "in due course be discussed by the NATO Council as to whether it is a good or a bad thing militarily to replace in due course the various bomber and other forces by a weapon of this kind." Mr. Macmillan later explained that it had to be considered first, from a military point of view, whether the provision of Polaris or some other missile "about five or six years ahead" was necessary to replace the present tactical bomber force.

We have, then, this Lockheed missile, which has already been proved as a seaborne weapon and which could, within months perhaps, be adapted for land-based operation, being held in prospect as a successor to aircraft—notably Britain's TSR.2—which have yet to fly and which cannot possibly be in service for years to come. Moreover, when these eventually do reach service they must reasonably be expected to remain in the front line for at least five to ten years. So whatever the time scale of Polaris development and operational readiness, there is a discrepancy here that is both puzzling and worrying.

It is this consideration, we suggest, and not so much the often-expressed concern that the Federal German Republic may be supplied directly with missiles of Polaris type, that calls for immediate examination. The German nuclear bogy is already taking form as the immense constructional programme for the Lockheed F-104G. For, although called Starfighter, this aircraft is a manned nuclear delivery system of great potency. This fact, we observe, has not passed unnoticed in *The Guardian*, though in ascribing to the F-104G a range "several hundred miles in excess of the 1,200 miles which is the aim of the present Polaris development team," that newspaper's leader-writer appears to have confused range with radius of action.

The Seaward Side

So much for the landward prospect of this double star in Europe. Britain's own immediate interest is a naval one. The position is that "an urgent study" has been instituted concerning the requirements for British-built submarines capable of carrying Polaris. But it must not be overlooked that the US Defense Department has stated that, although Britain could purchase these missiles, it is hoped that we should fall into line with the proposal that they should be under NATO management. There is scant prospect, in any case, of our having an operational fleet ballistic missile submarine in operation until 1970, by which time not only the *George Washington* but the *Patrick Henry* will have been serving with the United States Navy, with their full complement of Polaris, for some ten years. And they will have been joined by 43 others.

The Minister of Defence said the other day that we are not at a point where we need take a decision so far as the Polaris weapon system is concerned. Of the air-launched Douglas Sky Bolt, he said that we were now negotiating a firm agreement with the American Government which would ensure us a supply of these missiles "provided that the missile works." He added that he had every confidence that it would work, and we only had to wait some six or nine months to see.

It will be a consolation to him during those anxious nine months of gestation that Polaris will be twinkling so propitiously in a sky so dominated by Mars.

"Flight" photograph

ACADEMIC AFFILIATION: Two West German Fouga Magisters visited No 2 FTS last week. They are seen with a Jet Provost. Magister pilots: Flt Lts R. C. Chapman and F. Lofting of the RAF training mission in West Germany. Jet Provost pilot, Flt Lt N. Clayton

FROM ALL QUARTERS

P.1127 at Farnborough

THOUGH details of the Hawker P.1127 VTOL close-support fighter have still not been divulged, a Hawker Siddeley spokesman said last Monday that it "will be flying very shortly." Bill Bedford, Hawker chief test pilot, is likely to be at the controls. Another report refers to the possibility of the aircraft having its Bristol Siddeley BE.53 powerplant installed this week. Meanwhile, except for the morsel of news above, the Kingston-upon-Thames factory continues to preserve a tantalizing silence; but enough has been said to justify speculation on the P.1127's possible appearance at the SBAC Show.

U-2 and RB-47

ON July 19 the US Defense Department issued a report on three years of operations with Lockheed U-2s—omitting any reference to espionage. Much of the report is devoted to studies of radioactive fall-out. Six U-2s, based at Ezeiza Airport, Argentina, operated over both the Americas between 57°S and 71°N, collecting 3,986 air samples; the report gives full details of how the aircraft operated.

On July 25 Mr Cabot Lodge, US delegate to the UN, implied that the RB-47 shot down on July 1 was at all times visible to Western radars. A Soviet fighter, he said, had approached from the seaward side and "attempted to force the USAF machine over Russian territory," but the RB-47 had at no time approached within 30 miles of the coast. Sir Pierson Dixon, UK delegate, said that Britain had "reliable evidence" to corroborate this. Tacitly admitting that the aircraft was engaged in electronic espionage, Sir Pierson referred to Soviet trawlers and submarines which appeared to be engaged in similar operations but were not molested. The body of Capt Willard G. Palm, pilot of the RB-47, was handed over in Moscow on July 25.

The Queen at Cranwell

WHEN the Queen went to Cranwell last Monday to present a new Colour to the RAF College, and to review the passing-out parade of No 77 Entry, her visit concluded with a brief but varied and impressive flying display given by instructors.

This demonstrated three types of aerobatics—by glider, and by powered aircraft flown solo and in a formation of five. The glider pilot (in a Slingsby Skylark which he owns privately) was Flt Lt Douglas Bridson, who landed to well-deserved applause, for his sequence was beautifully planned and immaculately executed, from initial spin to final low run and stall turn.

The powered soloist was Flt Lt John Freer, who commands the College's Hunting Jet Provost conversion flight, and showed the Mk 3's agile qualities in a beautiful stall turn and a series of departing rolls. The de Havilland Vampire T.11 team led by Flt Lt Don Wood, a flight commander in the Advanced Flying Wing, gave an excellent demonstration of formation changing and a well-judged final bomb-burst. Its other members were Flt Lts Ralph Gould, John Whittam and Terry Edwards, and Fg Off "Bill" Bailey. Timing of the three display items was superlative.

During her review of the parade the Queen, who was accompanied by the Duke of Edinburgh, presented the Sword of Honour to Senior Under Officer P. J. Kemp and the Queen's Medal to Senior Under Officer N. Bonnor. The new Colour replaces one presented by King George VI in 1948.

FIRST IMPRESSION of the SRN-2 indicates the type of vehicle which Hovercraft Developments Ltd and Westland Aircraft (Saunders-Roe Division) are jointly building at Cowes. Weighing 25 tons, it will have a payload of 68 passengers or ten tons of freight and cruise at 70kt. Propulsion and lift are provided by four Blackburn A129s in an engine room aft; steering control appears to be by side ducts fore and aft

Clarence Stewart Thom

WE regret to record the death of Mr C. S. Thom, which occurred at his home last Friday, July 22, after a short illness. The news comes only four months after the announcement of his retirement at the age of 60 from the de Havilland organization, with which he had served for over 31 years.

Mr Thom—"Clary" to his friends throughout the industry—served during World War I with the RFC, learning to fly in D.H.6 trainers. Afterwards he spent ten years in the Shell-Mex aviation department, and then joined the D.H. sales department at Stag Lane, Edgware, his duties frequently taking him to countries overseas. When F. E. N. St Barbe was appointed a director in 1936 he took over as sales manager.

When war broke out Clary Thom set up the D.H. repair organization at Witney and then inaugurated the Second Aircraft Group at Leavesden, being responsible for the building of the factory and then for its management. Towards the end of the war he took over contract administration for D.H. manufacture and repair of aircraft, engines and propellers, returning as aircraft sales manager in 1944. In January 1951 he was appointed to the board as sales director. Latterly he was in the service of de Havilland Holdings Ltd as executive assistant.

SBAC Assistant Director

Mr Liddell Hart

A NEW appointment announced by the SBAC is that of Mr Adrian Liddell Hart as an assistant director. He will be specially concerned with economic and political trends, helping to formulate Society policy, and with external relations.

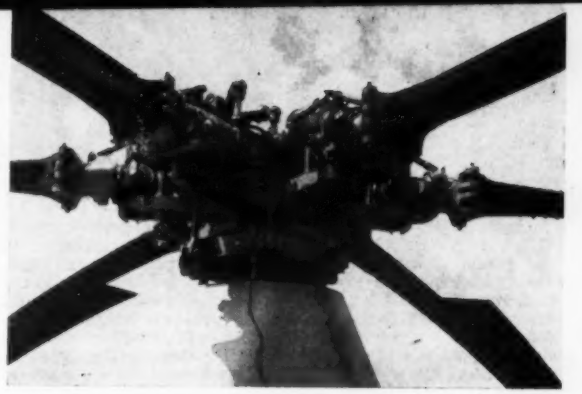
Mr Liddell Hart, who is 37, was formerly head of the Information Division of the FBI. After service in the RNVR during the Second World War he worked for the Foreign Office and the UN in New York and Berlin. He has been a writer and broadcaster, specializing in political and economic affairs.

The senior appointments on the SBAC staff are now held by Mr Edward Bowyer, chief executive and director; Mr H. W. Goodinge and Mr Liddell Hart, assistant directors; and Mr R. T. Hughes, secretary.

Service Gliding

INDIVIDUAL winner of the RAF Soaring Championships at Odiham last week was Sgt John Williamson of Technical Training Command, flying an Olympia 419. With a points total of 296½, Williamson was followed by Wg Cdr J. G. Croshaw, RAF Germany, Skylark 3B (266); Flt Lt F. D. Cretney, Maintenance Command, Skylark 3B (196½); Flt Lt G. A. Coatesworth, Bomber

***FOUR TO SIX:** Westland Westminster G-APLE (two Napier Eland) has been fitted with a six-bladed main rotor, designed and made by Sikorsky, for an extensive programme to investigate lift and blade-stalling problems. The Westminster's standard rotor diameter of 72ft is unchanged. G-APLE is the first British helicopter to have a six-bladed rotor*



***APPOINTED TO THE BOARD** of Rolls-Royce Ltd, as reported on page 162, is Mr D. P. Huddie (left), specialist in civil engines*

Command, Olympia 401X (185½); and Sgt A. Gough, RAF Germany, Skylark 3B (157¾). The inter-command contest resulted in the following placings: (1) RAF Germany, (2) Technical Training Command, (3) Maintenance Command, (4) Bomber Command, (5) Flying Training Command, (6) Fighter Command and (7) Transport Command.

On July 24, the day following the end of the RAF meeting, the Inter-Service Championships began at Odiham. The entry comprises eight aircraft and eight pilots from the RAF, six aircraft and eight pilots from the Royal Navy, and six aircraft and 11 pilots from the Army. On the opening day a goal race to Wroughton, Wiltshire, was initially set, but this was cancelled because of bad weather. Last Monday the task was distance along a dog-leg track from Lasham, with turning point at Firle Beacon and continuing through Deal Castle.

Peter Twiss's New Post

AFTER 16 years of test flying, latterly as Fairey's chief test pilot, Peter Twiss is giving up this work. Henceforth he will be responsible for the sales of Fairey Marine's motor-boats at Hamble.

Mr Twiss joined Fairey Aviation from the Fleet Air Arm at the end of the war, staying with the company until it was acquired by Westland Aircraft Ltd earlier this year. One of the outstanding post-war test pilots, in March 1956 he became the first man to fly at more 1,000 m.p.h. when he captured the world absolute speed record for Britain in the Fairey Delta 2 at 1,132 m.p.h. This exceeded the previous record by more than 300 m.p.h. and stood for almost two years.

Britannic Wings

PREPARATIONS for the production of wings for the Short SC.5 Britannic are well advanced at the Filton factory of Bristol Aircraft. Assembly jigs for the 71ft port and starboard sections are now being erected, and completion of the first wing is scheduled for March 1961. From then onwards, Bristol Aircraft will be delivering one set of wings a month to Belfast.

Bristol Aircraft are responsible to Short Brothers & Harland for the design and construction of the wing, and the initial production programme provides for ten sets, plus another for structural testing. To allow for fitting propellers up to 20ft in diameter at some future development stage, the span has been increased from the Britannia's 142ft 3½in to 158ft 9in, by mounting the wing assembly on a new 16ft 6in centre section. Distance between engine centres has also been increased by moving the inners about 4ft closer to the fuselage.

To meet the Britannic's higher maximum zero-fuel and landing weights, the structure has been strengthened, but the changes introduced do not prevent the use of some of the standard Britannia jigs and extruded sections. Modified leading and trailing edges, flaps and ailerons have been adopted, and the use of Rolls-Royce Tyne engines, in place of the Bristol Siddeley Proteus, has made possible a reduction in the size of the nacelles, which are underslung.

Panshanger Revival

FORTY-FOUR aircraft and a considerable number of cars brought guests to last Saturday's official opening of the revived London Aeroplane Club at Panshanger. Owner Nat Somers and manager Maurice Imray, and the club members and staff, had worked hard for success; and it attended them in full measure. Col C. F. H. Gough, MP, chairman of the Royal Aero Club, and Mrs Gough, were flown in by Sqn Ldr Stephenson, the aviation secretary, in a Piper Caribbean provided by the London Aeroplane Club and performed the short opening ceremony in an atmosphere of pleasant informality.

It is the aim of the club that their aerodrome shall become the centre in the London area for modern, executive-style aviation. Hangarage facilities are being increased, aircraft such as the Caribbean have been provided for members' use, and the clubhouse has been completely redecorated.

As a centre-piece for the day's show, the Morane Saulnier 880 Rallye, on its first visit to England, was flown in and spent a busy day demonstrating its capabilities. A three-seater tourer/trainer, the Rallye is not at first glance a beautiful aeroplane, but the production model will have a lengthened rear fuselage and swept fin and rudder, which will improve its looks. It is an all-metal, low-wing monoplane fitted with a number of high-lift devices, including full-span automatic leading-edge slots and wide, slotted flaps. Basic price here is understood to be £2,950.

IN BRIEF

After a long lapse of time, the FAI has homologated the world's absolute air speed record made on December 15 last year by Maj Joseph W. Rogers, USAF, with the Convair F-106A (P & W J75) at Edwards AFB, California. The figure of 2,455.736km/hr (1,525.5 m.p.h.) is confirmed.

The British team for the World Parachuting Championships, to be held in Bulgaria during August 7-17, will comprise Sgt Tony Charlton, Denis Lee, Flt Sgt Alf Card, and Mike Reilly, with Flt Lt Peter Hearn as reserve.

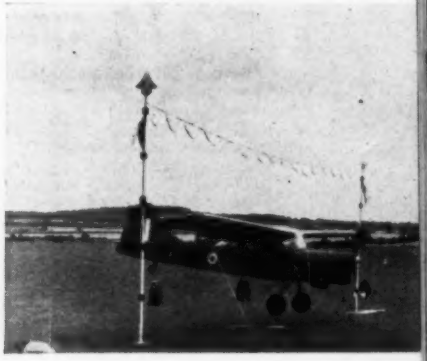
Capt Joe B. Jordan, the USAF test pilot who last December set up a new world altitude record in a Lockheed F-104C Starfighter (103,395.5ft), has been selected for the 1960 Harmon International Award, and another Harmon Award goes to Capt J. W. Kittinger in recognition of his high-altitude parachute jumps.

Capt John Jay Ide, USNR, has been awarded the Cross of Chevalier of the Legion of Honour by the French Government. He is now in his second term as a vice-president of the FAI and is also chairman of the FAI Sporting Commission. For many years before the war, and for a period after it, he was European representative of the NACA.

The distinguished Polish aircraft designer Zbyslaw M. Ciolkosz has died suddenly in his 59th year. Early in his career he was with the Polish PWS, PZL and LWS factories and since 1948 has lived in the USA, working with Piasecki, Hiller and latterly with Boeing. He was awarded the SAE Wright Brothers Medal in 1953 for his paper *Matching the Characteristics of Helicopters and Shaft Turbines.*

"Flight" photographs

***FIRST PUBLIC DISPLAY** by the Army Air Corps, held at Middle Wallop last Saturday, provided some out-of-the-ordinary flying events—and aeroplanes. The latter included the M.L. inflatable aircraft (centre picture below), a Bristol Fighter and a Bensen Gyro-Copter. Austers and Chipmunks put up a formation spelling the letters "AAC," and there was air drill by Skeeters (left). How happy the Army is with its AOP Austers for precision flying at zero altitude was also demonstrated (right)*



Missiles, Men and Mobility

ANOTHER COMMONS DEFENCE DEBATE

BY FRANK BESWICK

PARLIAMENT'S ultimate responsibility is to decide, in general terms, how Britain's available resources and skills should be deployed for defence purposes. Judging by the Commons debate of July 20—the third defence debate this year, excluding Service Estimate discussions—there is still controversy and indecision which cuts across party lines.

Two apposite statements preceded the debate. War Minister Mr Soames told of Territorial reorganization (the old nominal establishment of 300,000 is to be abandoned and a volunteer strength of 120,000 maintained—with superior equipment) and the Foreign Secretary gave details of UN action in the Congo. Students of these matters will probably note that there were hear-hears from all parts of the House when Mr Selwyn Lloyd stated that "UN forces and assistance teams . . . have already improved the situation."

Mr George Brown's theme was that the Government's policy depended upon weapons which we did not have and was related to situations which had changed. He was insistent that Sky Bolt did not exist, was unproven, had not been bought by the USAF, and, if not purchased by the Americans, would never emerge as a weapon available to us. Of Blue Steel, he claimed that the Mk 1 development would be open to the same criticism which led to the cancellation of the Mk 2, and in any case would never be considered but for the uncertainty about Sky Bolt. Alternatively—a clever point this—if Blue Steel was not open to this criticism of vulnerability, then the Mk 2 ought never to have been cancelled in favour of Blue Streak.

And then there was this question of mobility which popped up on every defence occasion. For this Army of ours, too small in numbers to do its job properly, mobility is essential. So said Mr Brown, and it has been said so often before. But, Mr Brown wanted to know, what about the freight-carrying aircraft to give us this mobility? What production order had been placed for the Britannic? Mr Wigg, who has persistently probed this Britannic business for more than eighteen months, interrupted his right hon friend to suggest that the question be phrased in terms of contracts—"Was there any signed *contract* for the Britannic?"

Mr Brown, who has been visiting, with colleagues, the Lockheed facilities in the USA, went on to say "would it not be better to recognize that we cannot get aeroplanes of our own to do this job in time? And, since we must support the Army properly and give it what it needs, would it not be better to go into the question of building the American Hercules under licence here? It could be built with Rolls-Royce Tyne engines in Ulster, as the Britannic will not arrive in time."

It needs to be recorded that there was absolutely no reply to these questions about the Britannic, or about our need for a long-range freighter. If, after all this time, the Government do respond to Mr Brown's invitation and think in terms of an American purchase then there certainly should be one of the most searching blame-fixing investigations of recent years.

The Nuclear Deterrent

George Brown, who bravely over the past four years has argued Labour's defence case, made little attempt to deal with the party's new policy statement which proposes to leave responsibility for the Western nuclear deterrent to the USA. He did appeal, however, for British influence to be used against the proposal to equip German forces with Polaris. A nuclear missile capable of hitting Moscow and beyond from the German frontier was a strategic weapon and if used would ensure any trouble in Central Europe immediately leading to total nuclear war.

Mr Watkinson said the Government's position was plain on this question of the nuclear deterrent—"We do not believe it is immoral or improper or unwise to possess the capacity to manufacture and to deliver nuclear weapons whilst they are also possessed by Russia."

Because Blue Streak had been cancelled as a vulnerable weapon on a static site was no argument for scrapping Thor. Blue Streak would not have been operational until 1965 and Thor was deployed today. He claimed that the Opposition was distorting and dismissing the time scale. Mr Healey intervened to say that evidence suggested that Soviet missiles were sufficiently accurate as of today to destroy the Thor sites. The Defence Minister said there were signs in current tests of increasing Soviet accuracy but they must be related to the time scale and a balanced view taken.

As for the V-bombers, Mr Watkinson said the Government had "a very clear plan." Today there were the V-bombers with the free-falling bombs with nuclear warheads made in this country. The ability of this force to take off at short notice was comparable with that formerly expected from fighters.

The first step for the future was to replace the Mk 1 V-bomber with the Mark 2. To this would be fitted Blue Steel with a megaton warhead. This weapon had reached the stage at which launching trials are taking place from Mk 1 V-bombers. What Mr Watkinson wanted to see was a steady improvement in the range of Blue Steel which would increase its value and keep it valid over a longer time-scale to meet expected improvements in enemy defence.

At this point Mr Wigg rose slyly from his bench below the gangway and asked if the Minister was aware that in 1957 his right hon. friend Mr Sandys had said that the role of the V-bomber was limited and that no successor would be provided. Yet they were now talking of fitting these machines with new weapons up to the middle 1960s.

Mr Watkinson retorted that the V-bombers were perfectly valid until the early 1970s. Sir Arthur Harvey asked if he would clear up the doubts which had arisen since a newspaper article had predicted reductions in the numbers of Mk 2 V-bombers. The Minister said "no decision of that kind has yet been taken." But he was not committing the future one way or the other.

Sky Bolt and the V-bombers

As to Sky Bolt, there was every reason to believe that it would be available when wanted and that it could be fitted without difficulty to the Vulcan Mk 2. No decision had been reached about the Victor 2, but the latest information was that Sky Bolt could be fitted to that machine if it was wished to do so. Armed with this missile, repeated Mr Watkinson, the Mk 2 V-bombers would make an effective contribution to the deterrent until the middle 1970s. And, said the Minister, "to use Sky Bolt as some kind of alibi for some kind of major change in Socialist defence policy is for the right hon. gentlemen to delude their own party and their country as well." At which Mr Brown asked: "When did the Americans decide to order this weapon for their Air Force?" To this the following reply was offered: "The United States Air Force has disclosed a very large requirement for a very large number of missiles. . . . We also have disclosed a requirement for, of course, a much smaller number of missiles. We are now negotiating with the American Government a firm agreement which will ensure us a supply of these missiles, provided that the missile works." After the laughter following this remark had subsided Mr Watkinson went on to explain that he had every confidence that it would work and that as we have to wait only some six to nine months it did not seem a very large risk to take.

To disprove the charge of inadequate equipment the Minister of Defence gave a long list of items, mostly familiar, now coming along. They included: Sea Vixen, first squadron embarked in *Ark Royal* earlier this year; the NA.39 production order placed; the first Vulcan 2 delivered this month; the AW.660 medium-range transport, 40 ordered and the first to be delivered in 1961-62. There was no mention, as already noted, of a signed contract for the Britannic.

The point about mobility was picked up by Reginald Paget. No one speaks more fiercely than Mr Paget—nor makes fewer enemies. He attracted amused support all round when he said, "We have requirements. We require a mobile force. The force of the UN has been congratulated for its speed. I am rather struck by the fact that Mr Hammarskjoeld with his mixed bag seems to be able to move a jolly sight quicker than our integrated force did at Suez."

To get this debate into balance one should pay particular attention to the speech of Sir Fitzroy Maclean. Behind this former Under-Secretary of State for War, showing ostentatious support, sat Mr Nigel Birch, a former Treasury Minister.

Sir Fitzroy said he was not going to talk of rockets as enough, or more than enough, had already been said about them. Among other things, all the talk of rockets and streamlined nuclear warfare had been bad for recruiting. In the cold-war period matters were going to be settled by men on the ground. The Congo gave us a hint of what could happen in Africa. We had insufficient men on the ground. Overseas units were lamentably under strength. The figure of 165,000 regular forces, which it was hoped to attain, represented not an estimate of what we needed but an optimistic guess of what we might recruit. General Hull's committee had put the lowest safe minimum at rather more than 200,000 men.

The Secretary of State for War, winding up, found it easier to trounce Labour's defence statement than to answer Sir Fitzroy Maclean's case. He insisted again that, despite all the pessimistic prophesies, Sky Bolt would be a credible deterrent from, say, 1965 to 1970. But if this debate leaves any impression upon the planners it will be to emphasize the argument that Britain needs more conventionally armed men and more machines capable of moving them and their equipment quickly—much more quickly.

"Double-lift" rescue procedure, used when the occupant of a dinghy is injured and has to be raised by a crewman, being demonstrated to members of an HSE course by a Whirlwind crew of No 22 (ASR) Sqn

SIMULATING HUNTER EMERGENCIES

RAF Chivenor Reaches Its Hundredth Course

By HUMPHREY WYNN "FLIGHT" PHOTOGRAPHS

RECENT successful ejections from RAF fighter aircraft have underlined how important it is for crews to be familiar with emergency procedures. In Exercise Yeoman, during May, two Javelin pilots and two navigators lived to fly again after their machines had collided at 40,000ft; and a few weeks earlier Fg Off John Cleaver of No 43 Sqn survived ejection off Cyprus.

He had taken the Hunter simulator and emergencies (HSE) course at RAF Chivenor, Devon, and after his Mediterranean rescue sent a letter to those who run it expressing gratitude for the instruction he had received. While at Chivenor he had set up a record time—15½sec—for inflating and entering a dinghy at sea.

A large number of Hunter pilots have taken the HSE course, and with No 100 due to start on August 8 this seems an appropriate time to describe the extent and style of instruction given, *Flight* having recently been able to participate in one of the courses.

This visit stemmed from an earlier one Ian Macdonald and I paid to Chivenor (*Flight*, April 15) to see the workings of No 229 OCU, which trains all the RAF day intercepter pilots. We felt then that if we were to fly as passengers in high-performance aircraft, where seconds count in an emergency, we should become reasonably familiar with the equipment we were to operate; and I also considered the HSE course merited a feature on its own.

There were four pilots on the course we joined, three of them from Hunter squadrons: Sqn Ldr L. W. Phipps, who commands No 19 Sqn; Flt Lt J. E. Vickery of No 65 Sqn and Fg Off P. D. Blockey of No 54 Sqn. The fourth member of the course, Flt Lt I. H. Laurie, came from the Ferry Wing at Benson.

At 8 o'clock on the Monday morning work started with a briefing by Sqn Ldr B. Byrne, who is OC simulator section. Like the other eight instructors in his section, the squadron leader is an experienced Hunter pilot; and like all the other tutors at No 229 OCU he wears his magisterial authority with good-humoured style: teaching at Chivenor is informal and friendly.

Sqn Ldr Byrne gave an initial warning about over-controlling the simulator, a fault which he finds everyone is prone to on their first experience. He emphasized that pilots are responsible for their own navigation from the 2nd sortie onwards, and warned about the "rapid deterioration of weather" which may occur during exercises. He also said that it was possible to bale out, the simulators being fitted with a combined hood and seat ejection. Each sortie lasts 1hr 40min, made up of 20 minutes' briefing, an hour's flying and 20 minutes' de-briefing.

The intention of Macdonald and myself in going to the HSE course was to study the use of emergency equipment, the ejection seat and lifejacket in particular, so that when flying in Service aircraft (a pleasurably frequent occurrence) we would know what to do in the event of an emergency; we would also know the exact meaning of all the cockpit connections and "strappery."

The simulator course, therefore, did not strictly come within our sphere of study (it was referred to in some detail after our previous visit to No 229 OCU, in the April 15 article); but nevertheless I had the opportunity of a sortie in one of the simulators, which are products of the Air Trainers Link Division of General Precision Systems. Not being a Hunter pilot, I could not compare it with the actual machine; but the experience of flying it was quite stimulating: I felt a sense of power which was lacking in the old type of Link Trainer. Most of the time I spent chasing my instruments, owing to unfamiliarity with the Hunter's speeds.

During the sortie I tried the effect of powered-control failure, and found all my strength was needed to move the control column. The exercise I did was a straightforward take-off, climb, cruise, descent and landing; and I earned at least a negative compliment from the instructor when he commented that not everybody managed to get the aircraft safely back on to the ground! There seems to be a proper sense of realism about these simulators, and (as was mentioned in the previous article) every type of emergency —operational or mechanical or pilot-induced—can be tried.

Nine simulator exercises are carried out during the course, as follows: (1) familiarization (i.e. cockpit checks, general handling, QGH); (2) cross-country; (3) cross-country at maximum range, including a diversion; (4) QGHs using the DME homing needle and ranges only; (5) concentrated emergency sortie (about twenty emergencies in 45min); (6) and (7) instrument rating tests, with emphasis on emergencies (normally fed in at inopportune moments); (8) control interceptions; and (9) IR test (as Exs 6 and 7, clearing up points where the pilot has made mistakes).

Macdonald and I began our real study with the "emergencies" part of the course, thirteen one-hour periods in the five-day syllabus being devoted to the proper use of emergency equipment, plus dinghy drill.

Two instructors are in charge of this section of the HSE course, Flt Lts Brian Batt and John Firth. At the time of our visit, Flt Lt Firth had only just arrived at Chivenor and sat in on the lectures, which were given—with an attractive compound of clarity, wit and sound commonsense—by Flt Lt Batt.

Batt dealt first with rescue and survival equipment, detailing the aids carried in the Mk 4 lifejacket as (a) SARAH; (b) heliograph; (c) ground/air emergency code; (d) McMurdo light; (e) whistle; and (f) sea dye marker. On each of these he gave useful information. SARAH, which has an endurance of about 20hr, can be used either on sea or land; but its ranges vary in these contexts. From 15,000ft the sea range is 75 nautical miles, land range 45 n.m.; from 10,000ft, 65 and 35; and from 5,000ft, 45 and 15 n.m. Comprising a battery, transmitter and hand microphone (the latter to be sparingly used), and aerial, SARAH can be extracted entirely from its nesting-places on the lifejacket; in fact

What the well-dressed fighter pilot wears, and the equipment he can use to assist survival, displayed in one of the Chivenor lecture-rooms

Above, members of the course which "Flight" attended being briefed on helicopter rescue by M.Nav F. P. Watts of No 22 Sqn are (from left to right) Fg Off P. D. Blockey, Flt Lts I. H. Laurie and J. E. Vickery, and Sqn Ldr L. W. Phipps

Left, Flt Lt Laurie about to "ditch" in Ilfracombe Baths, with his right hand ready on the quick-release box

Below, last-minute briefing by Flt Lt Batt (left) for Blockey and Laurie, with Humphrey Wynn—not feeling so apprehensive as he looks—in the centre. Flt Lt Firth is on the right

SIMULATING HUNTER EMERGENCIES . . .

one of the first priorities, once an ejectee is installed in his dinghy, is to get it working. (SARAH is apparently to be replaced by SARBE—UHF—equipment in about a year's time.)

Most of the other equipment in the lifejacket is self-explanatory: the important thing about the Chivenor course is that pilots have every bit taken out and shown to them, so that it is made clear that nearly every bulge contains something useful.

The heliograph is used for attracting attention (when there is sun available to provide message-power) and has a range of 4/5 miles; the ground/air emergency code explains what signals to lay out; the McMurdo light (which lasts about 8hr) is for re-grouping members of a crew in darkness—or alternatively, as Flt Lt Batt commented drily, for re-reading pilots' notes; the whistle is similarly used for attracting attention, and the sea-dye marker—the dye is poisonous—spreads a patch on the water.

As well as seeing the contents of a lifejacket, we were shown the dinghy and told how to inflate it and get into it, while Batt added several useful points of information.

One was that the CO_2 bottle should be held firmly under water until its job of inflation was finished; another, that the dinghy should be entered by pushing down on the narrow end with both hands, and falling aboard at the same time, then using the loops provided to get further aboard. Batt gave a useful tip for judging height above the sea, so as not to press the parachute quick-release box too soon: take off your bone-dome and drop it into the water, watching how long it takes to reach the surface. He showed how the metal studs (to be replaced by "touch-and make" nylon) on the two sides of the canopy should be fastened up, protection being No 1 priority once one is in the dinghy.

In order of priority, the principles of survival (applying to the land as well as to the sea) were listed as follows: (1) protection, (2) location, (3) water, (4) food and (5) other aids.

The survival pack was likewise dissected and explained: it contains 1½ pints of water, socks, gloves and a hat (all located in the seat cushion); first-aid kit; knife; sea survival pamphlet; two de-salting kits (two pints of water can be made with each); two tins of Mk 4 emergency flying rations; 2-star reds (there are six in the "J" pack: but the 2-star red is going to be replaced by Signal Distress, Day/Night Mk 1—American origin, British-made in this country under licence); a tin containing a fishing line; hooks and a spinner; burning glass; sharpening stone; six ER razor blades; water purification tablets; a pair of paddles; and a compass. There is also a solar still which should give 1½ pints of water in an eight-hour day: Flt Lt Batt demonstrated how this should be used.

We had a practical demonstration on the airfield of being winched up into a helicopter, either putting the harness on ourselves or being double-lifted (the procedure in case of injury) by a crewman. This exercise was carried out with a Westland Whirlwind of No 22 (ASR) Sqn, on detachment at Chivenor.

Realistic tests of dinghy drill also form part of the HSE course: one (in which Ian Macdonald and I participated) takes place at Ilfracombe Baths, the other in Barnstaple Bay—with the co-operation of the Appledore lifeboat. The sea dinghy drill we attended on our previous visit to Chivenor, though as spectators; this time we plunged in the baths with members of the course, and although we didn't break any records—Macdonald took about 36sec getting aboard and I took over 40, because my dinghy inflated upside down—it was a very useful experience. An important aspect of the course is that it builds up confidence in using equipment.

This is especially useful when ejection seat procedure is described. Three types of Martin-Baker seat, the Mks 2H, 3H and 4H, are on view in one of the lecture rooms, and Flt Lt Batt described the differences between them. (For example, with the Mk 4 you don't need to cross the leg-restraining straps; they are already crossed under the seat cushion.) He also outlined the pre-flight checks which should be done: the safety pins, to make the seat safe on the ground, should be left in until the last minute; there should be no red mark showing on the top latch (pin fully in on the later type of latch); and the drogue gun safety pin should be out. Batt stressed that correct posture is very important before ejecting, and that if any pre-ejection "strappery" can be done, so much the better.

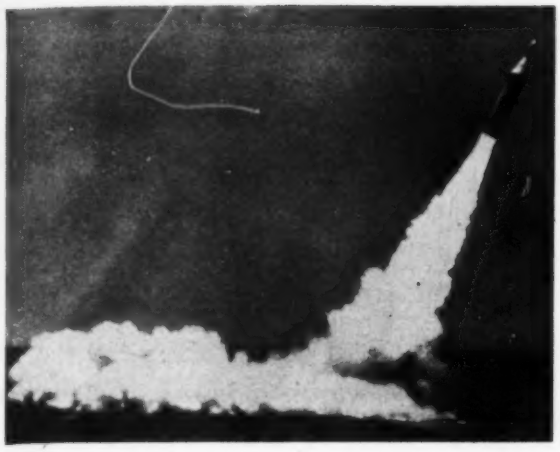
There are certain minimum heights and speeds to ensure safe ejection. For example, with a seat modified for ground level ejection, the minimum speed is 90kt on the runway. Normally (as has often been proved) all should go well. Having pulled the blind, the canopy flies off; one second later out you go, complete with seat, which separates from you after the automatics have run through, and all you have to do is to make a safe landing (a technique which is taught in the gymnasium at Chivenor).

In the unlucky event of the ejection mechanism failing to operate, you can release the canopy, and bale out minus the seat (provided that you have remembered to "isolate" yourself); or if the seat fires successfully but fails to detach itself from you, the No 1 "D" ring should be pulled (to isolate oneself from the automatics), and then No 2 to deploy the parachute manually, when clear of the seat.

Films shown at Chivenor as part of the HSE course illustrate the ejection seat in operation; and there are also films on survival at sea and on the land, parachute techniques and under-water ejection. The HSE course forms a comprehensive five days' instruction, giving Hunter pilots invaluable tuition in the drills which, if carried out correctly, can save their lives in emergency.

The following manufacturers are among the suppliers of the emergency equipment mentioned in this article:—

R.F.D. Co Ltd	Dinghies and survival packs
P. Frankenstein & Sons Ltd	Lifejackets and immersion suits
Martin-Baker Aircraft Co Ltd	Ejection seats
Lea Bridge Industries Ltd	Solar stills
Walter Kidde Co Ltd	Lifejacket inflation bottles
Irving Air Chute of Great Britain Ltd	Parachutes
G.Q. Parachute Co Ltd	Parachutes
Ultra Electronics Ltd	SARAH



As noted in a paragraph on this page, USS "George Washington" fired two Polaris missiles from a depth of 90ft on July 20. The first missile (left) left the water some 15° away from the vertical and was corrected following first-stage ignition

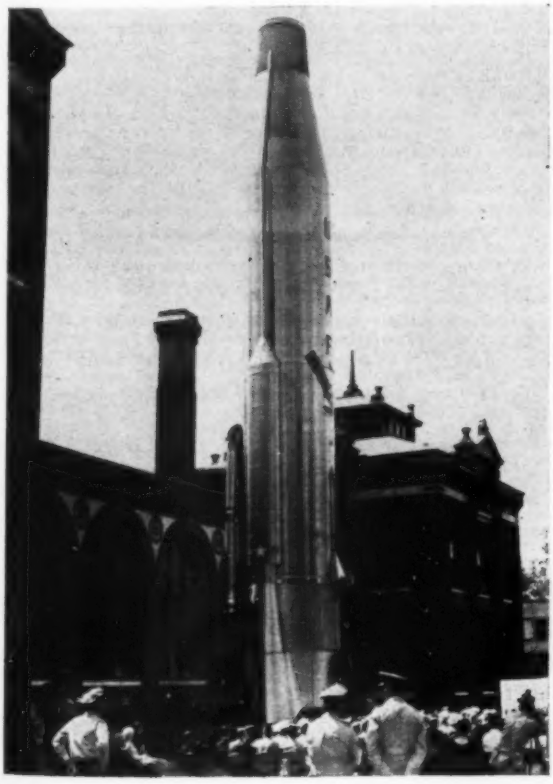
The second Polaris (right) was fired some three hours later. Both achieved completely successful missions

Missiles and Spaceflight

COMPLETE POLARIS MISSION

In last week's issue, and on pages 147-150, we have presented a comprehensive account of the development of the Polaris submarine-launched ballistic missile of the US Navy. This great weapon surmounted its culminating hurdle on July 20, when two were fired on full-range missions from the first Polaris submarine, SSB(N) 598 *George Washington*.

For several months *George Washington* has been based at Port Canaveral, Florida, at the head of the Atlantic Missile Range.



After firing at least 30 test "slugs" to check out her 16 missile tubes, she took aboard two real Polaris on the night of July 19, and slipped her moorings early next day, with 307 crew and technicians aboard. After making a rendezvous with the surface ship *Observation Island* about 30 miles off-shore, she submerged and began her firing run 90ft down at 2kt. This is apparently rather deeper than the normal operational depth.

After a green smoke-float had popped to the surface the final seconds of the countdown ticked away until, a second or two after "zero," the orange re-entry vehicle thrust its nose obliquely out of the blue ocean. Owing to the considerable firing depth the missile almost stopped just above the water, but the first stage fired promptly, correcting the non-vertical attitude in about 2sec (see picture). Observers on shore saw the thin smoke trail, and the inter-stage separation 55sec from the launch. Impact took place in the prescribed area north of Puerto Rico, 1,100 miles down-range. Missile No 2 followed 3hr later, and, leaving the water much nearer to the vertical, also flew a perfect 1,100 mile mission.

A BRITISH SKY BOLT?

In the Defence Debate in the Commons on July 20, Harold Watkinson, Minister of Defence, made it quite clear that a great deal of thought is being given to the possibility of Britain developing an indigenous ALBM for Bomber Command. This suggestion —which was first implied by him earlier this year—should further increase the effectiveness of the Vulcan B.2 and Victor B.2.

His words were: "Sky Bolt will cost a great deal less than Blue Streak because the R and D cost is being covered by America. Supposing that out of our spare resources we decided to diversify the deterrent and produced a missile as a partner to Sky Bolt which was entirely made by us, would the right hon. Gentleman then change his policy again?" After George Brown, "Shadow" Defence Minister, had asked whether this was to happen, Mr Watkinson replied, "That is for the Government to decide."

CORVUS CANCELLED

Under development since 1955 by Northrop's Radioplane Division, the Corvus air-to-surface guided missile was cancelled by the US Navy on July 19. In their view it was "more limited in its application than other systems now under development." Total funding at the time of cancellation had been approximately $80m.

Corvus, or ASM-N-8, was a beautifully streamlined aerodynamic-cruise device with a range of the order of 100 miles. It was intended to be carried by such carrier-based aircraft as the A4D, A3J or F4H, and in its major role would have been used to home on to enemy electronic installations and destroy them. The first flight-test prototype was successfully fired from an A4D at Point Mugu exactly one year ago (*Flight*, August 21, 1959).

SPACEFLIGHT APUs

Two American companies have announced their work on new systems to provide power for advanced satellites and space probes. Martin's Nuclear Division have started testing SNAP 1-A, a compact generator fed from a nuclear reactor, which is under contract to the Atomic Energy Commission. Promising more

On June 28 the US Air Force gave a D-Model Atlas ICBM to the Smithsonian Institution in Washington. Unlike previous display Atlas missiles, this specimen is clearly genuine *(comments appear on p. 153)*

Missiles and Spaceflight . . .

energy continuously than any space power system so far launched, it has a rating of 125W at 28V. The complete unit weighs 175lb and has a diameter of 24in and length of 34in. The fuel capsule contains pellets of cerium 144, which is currently being separated at Oak Ridge. Unlike solar cells, SNAP 1-A will be unaffected by micrometeorites and will continue to deliver power while in the shadow of the Earth.

The other new APU is under development for the USAF Air Research and Development Command by the Hamilton Standard Division of United Aircraft. It is to be of the solar type and, after testing with a 100W prototype, will be produced as a 1,500W unit suitable for satellites in 90min orbit. The smaller version, which is to undergo static test this autumn, will consist of 900 aluminium reflectors, each with a diameter of 4in, assembled in groups of 28 to focus the Sun's rays on to collectors from which the heat will be transmitted to a thermocouple. Temperature difference across the thermocouple should be some 600°F (1,000/400°F). Operationally the generator will be automatically unfolded in space and will be employed in conjunction with chemical batteries to provide power in the Earth's shadow.

PIONEER 5 SILENT

The last radio communication from the US space probe Pioneer 5 was a six-minute message received at Jodrell Bank on June 26, at which time the probe was 22.5 million miles from Earth and moving at a speed relative to the Earth of 21,000 m.p.h. The previous long-distance communication record was 407,000 miles by Pioneer 4. Repeated attempts to contact Pioneer 5 after June 26 were unsuccessful and no further attempt is being made.

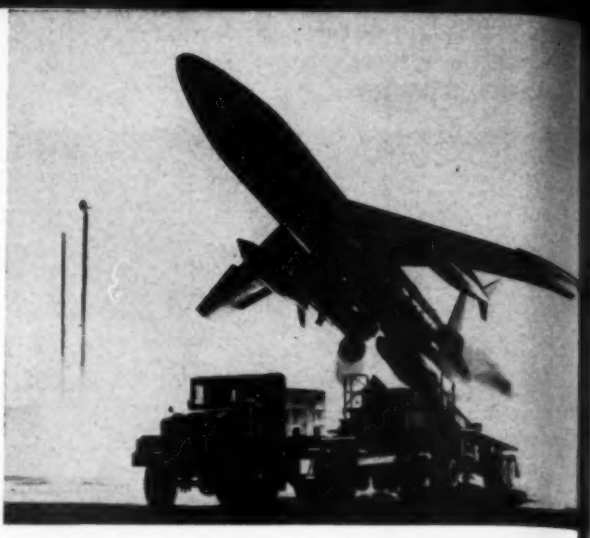
Launched on March 11 from Cape Canaveral, Pioneer 5 used a five-watt transmitter for most of the time during its 106-day active life. The 150-watt transmitter was not used during the first four weeks but responded promptly when commanded for the first time on May 8 when the probe was eight million miles from Earth. Subsequent use of this transmitter was limited because of an apparent deterioration of the probe's 28 batteries.

Three possible reasons for the loss of contact with Pioneer 5 have been suggested: (1) The probe may simply have exceeded the possible transmitting range from Earth of the five-watt unit (earlier estimates of this range were approximately 20 million miles); (2) Battery failure or leakage induced by the "hard" vacuum of deep space. The batteries were charged constantly by solar cells in four paddles extending from the 26in diameter spherical payload; (3) A failure of some other important component or system.

A complete analysis of the performance of Pioneer 5 is being made by NASA and Space Technology Laboratories. The data transmitted by the probe during its 138.9hr of transmission has established the following new items of scientific information:

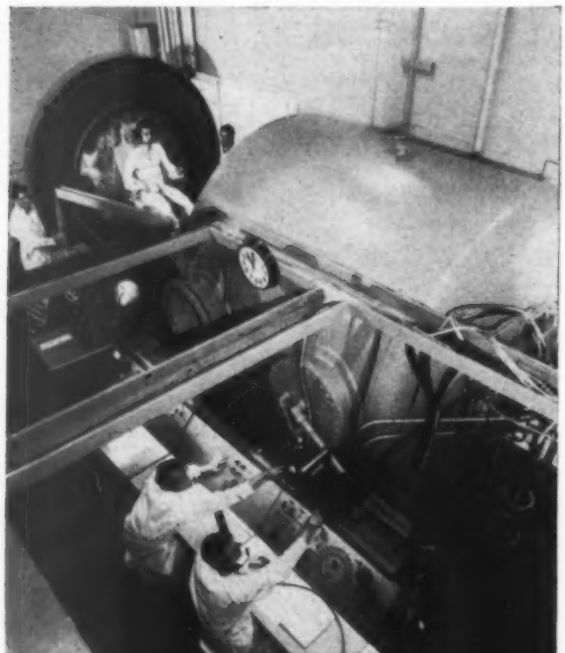
1. Detection of solar particles in transit between the Sun and Earth, at a distance of millions of miles from Earth.
2. Sudden decreases in cosmic ray intensity, known as the Forbush decrease, do not appear to depend on the Earth's magnetic field.
3. The intensity of the outer Van Allen radiation belt around the Earth is not produced directly by the injection of electrons from the Sun. Simultaneous measurements by Pioneer 5 and Explorer 7 indicate that the electrons are somehow accelerated to higher velocities after being caught in the Earth's magnetic field.
4. Magnetometer data can be explained by the existence of a large ring current circulating around the Earth at from about 30,000 to 60,000 miles. The total current flowing in this region has been computed at five million amps.
5. Evidence that the Earth's detectable magnetic field extends as far as 64,000 miles from the Earth.
6. Suggested existence of a measurable interplanetary magnetic field.

Scientific data obtained during the flight came from instruments built by Space Technology Laboratories, the University of Chicago and the University of Minnesota. The probe's orbit around the Sun will cover a distance of approximately 515 million miles, and Pioneer 5 will fly 18 million miles closer to the Sun than any other man-made object.



Last week we presented on this page a series of photographs showing the separation of the warhead of a Northrop SM-62 Snark. The photograph above, which shows the launch of one of these intercontinental aerodynamic-cruise missiles under the thrust of its twin 130,000lb boost rockets, is the first to depict a Snark in the markings of USAF Strategic Air Command. Snarks are deployed with the 702nd Strategic Missile Wing at Presque Isle, Maine

This Boeing "multi-stress" chamber, now nearing completion, is part of a space-research programme to determine human tolerances and equipment capabilities. In it, the "pilot" will be subjected to noise, intense light, vibration, and variations in pressure, temperature and atmospheric composition



A five-stage Strongarm 3 sounding rocket designed to measure electron densities in the upper atmosphere was launched from Wallops Island, Virginia, on July 13.

On July 18 the month-old strike of 10,500 members of the IAM employed by Lockheed's Missiles & Space Division, was terminated by the company award of an extra 4c per hour, and the promise of 3c per hour next year.

The final stage of the carrier rocket of Sputnik 4, the Soviet "spaceship" satellite, re-entered the dense layers of the Earth's atmosphere and "ceased to exist" on July 17. This was reported by the French astrophysics observatory at Meudon on July 18, and confirmed by Tass on July 19.

Robert C. Seamans Jr, chief engineer of the Missile Electronics and Control Division of the Radio Corporation of America, has been appointed Associate Administrator of the National Aeronautics and Space Administration. He succeeds Richard E. Horner, who has joined Northrop Inc as senior vice-president, technical.

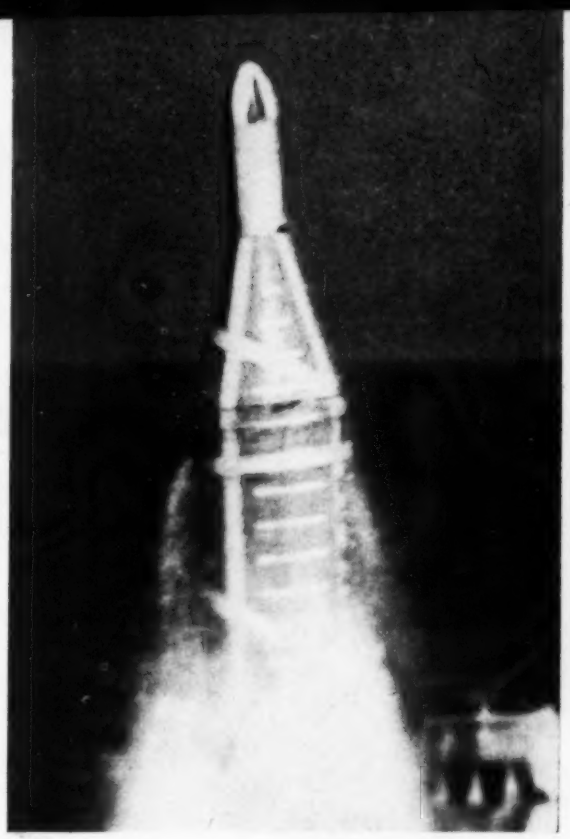
Three authors of a Northrop Corporation satellite rendezvous study have been named joint winners of the US Institute of Navigation's first annual Samuel M. Burks Award. The award, given for outstanding contributions to knowledge of space navigation, went to Norman V. Petersen, Leroy R. Hoover and Dr Leonard Pode for a paper, entitled *Satellite Rendezvous Navigational Requirements*, which explores the problems of bringing together manoeuvrable satellites in space.

A contract for the development and test of a guided recovery device which will use rotor blades in place of a parachute, and for the study of its ultimate application to manned space capsules, nosecones and large rocket boosters, has been placed with Kaman Aircraft Corp by Air Research and Development Command of the USAF. The device will be a version of the Rotochute already developed by Kaman.

POLARIS

Part 2: The Test Programme

BY THE TECHNICAL EDITOR



IN last week's issue it was emphasized that the FBM programme presented an unusual number of fundamental problems. To find the answers a whole range of test installations was constructed in California and several other states and on, or under, the Atlantic and Pacific oceans.

Some of the first tests carried out in connection with the launching system were done during the autumn of 1957 at Hunters Point, San Francisco Bay, as Operation Peashooter. During 1957 a boilerplate launch tube was set up on trunnions on the shore, and coupled to a pneumatic system. Initially the rig was used to launch dummies machined from huge redwood trunks. The next stage was to fire full-scale models filled with concrete to give the correct weight and centre of gravity, straingauged and otherwise instrumented to record accelerations and stresses. Although weighing 14 short tons apiece, the dummy missiles were flung well over 100ft into the air.

During 1957 the entire test programme was mapped out in detail. Owing to the diverse nature of the weapon system the programme was blocked into major performance areas involving the missile, the launcher and their mutual compatibility. The first tests of actual hardware were generally conducted on the ground. To perfect the warhead and re-entry body a team of Navy and AEC scientists conducted extensive static testing to determine the optimum nosecone materials, the shape and type of the thermonuclear bomb, the arming and fuzing of the warhead and the configuration of the complete re-entry body itself. Air-drops, flight tests and many hundreds of hours in tunnels and shock tubes demonstrated the feasibility of the Polaris re-entry vehicle. When it was designed it was radical, but the configuration is no longer questioned and similar shapes are flying on Atlas and Titan.

To prove the guidance system statically involved supersonic sled runs of the gyros, accelerometers and stable tables, and centrifuge whirl tests of the components and finally of the complete airborne system. Several thousand circuit-design and compatibility tests were involved in order for guided test vehicles to fly during 1959. Major areas for exploration in the field of propulsion concerned the propellant material, the thrust-termination system, the materials for the motor cases, the manufacturing techniques for the cases and propellant, and the thrust-vector system. Both small- and full-scale testing was extremely comprehensive, since very high reliability had to be demonstrated with exceptional specific impulse on a scale never before attempted.

Following static testing of portions of the airborne system, behaviour in flight and compatibility with the launch tube had to be demonstrated by full-scale flying vehicles. The first family of such vehicles were dubbed "Polaris jg" (jg being the US Navy rank-suffix meaning Junior-Grade). About as long as Polaris, but looking sadly underfed, these vehicles were fired in appreciable numbers from Cape Canaveral. Throughout this phase much of the data were of value to the USAF, and the fullest interchange was maintained to reduce costs, just as it had been on Lockheed's earlier X-17.

Test vehicles were divided into groups, each specially instrumented to provide answers for a particular range of problems. The first group were employed in such basic areas as instrumentation, telemetry and analysis techniques, although they also provided limited information on thrust-termination. The second block gave much usable information on thrust-termination. The third group, of the skinny jg variety, yielded a great range of data and confirmed many conclusions regarding re-entry body shape, materials and behaviour. The next blocks of vehicles were used to verify the design concept for flight-control components, and for environmental flight testing of actual hardware from both the control and guidance systems.

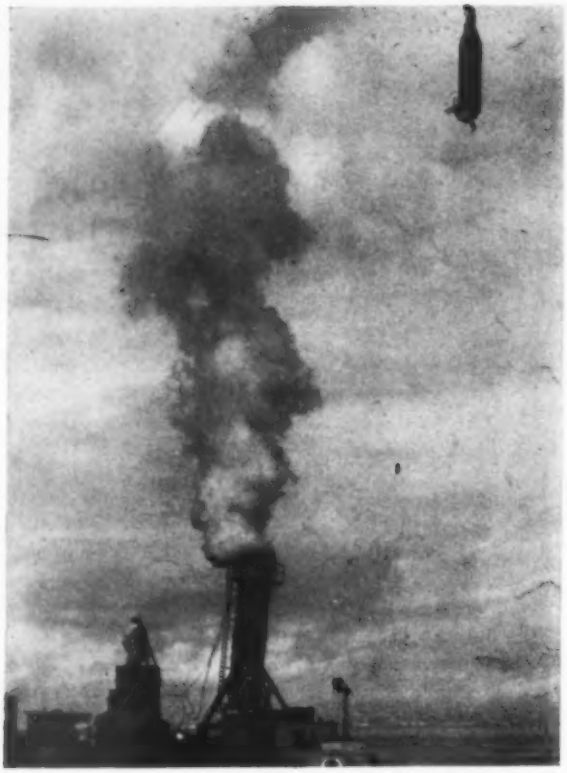
All these flights started from the Air Force Missile Test Center at Cape Canaveral. Here, on a 36-acre site adjacent to Port Canaveral, Lockheed and the Naval Ordnance Test Unit maintain Complex 25 for Polaris flying. Pad 25A includes a simple launcher which holds the missile well clear of the ground so that engine behaviour can be studied during the launch sequence. Associated with it are an umbilical mast and hydraulically retractable access tower. Pad 25B consists of a ship-motion simulator. Constructed by the Loewy Hydropress division of Baldwin Lima Hamilton, this device comprises a launch tube carried by vertical hydraulic rams with which the tube axis may be displaced from the vertical in any desired manner while the tube itself is raised and lowered, thus simulating the motion of any type of ship in any given sea condition. This arrangement contrasts with the British Clausen Rolling Platform at Aberporth, which is actually floating in calm water and so cannot move vertically.

Preliminary investigations into the hydrodynamic behaviour of the missile were conducted in water tunnels and various other ground rigs. Nevertheless, the fact that transition from one medium to another is involved during the launching presented an unusual modelling problem, making a conventional tank inadequate. In order to obtain results directly applicable to the full-scale missile it was essential for the ratio of the significant forces exerted by the fluid to be the same for both. In investigations involving a free surface, such as the water/air boundary, gravity and inertia forces are very important and for them to be reproduced in model form the Froude number should be the same at all scales. Gravity forces may be eliminated when the free surface is far enough away from the vehicle to be unimportant, but even then the inertia and viscous forces should be correctly ratioed, and the Reynolds number also. In the case of Polaris the Reynolds number is unimportant, but Froude and pressure scaling are essential. To accomplish this in model form it was essential to reduce the air pressure above the water surface, and accordingly Lockheed built a tank surrounded by a pressure-tight shell which could be partially evacuated.

Owing to the complicating factors already mentioned it was impossible to investigate the actual hydrodynamic performance of the missile in a water tunnel; an obvious factor which cannot be simulated is the rapidly falling hydrostatic pressure which the missile experiences as it rises. To investigate the behaviour of the missile under these conditions a test vehicle need not be structurally correct, and the first series of underwater test vehicles were boilerplate devices which, while having the correct hydrodynamic form, weight, moment of inertia and centre of gravity, could be made strong enough for unexpectedly high loads to cause no damage. In particular, they could be made to withstand undersea launching and the subsequent crash back into the ocean from an apogee of over 100ft. Under the code-name of Pop-up, underwater launching of full-scale boilerplate vehicles started in January 1958 in Southern California waters near San Clemente Island. Only a few such tests were required to prove the basic feasibility of the underwater launch, and in each case the vehicle was caught in a vast circular net suspended just below the water surface by radial float systems.

Such an arrangement is of limited value, since it gives no indication of how the actual missile would behave. For such launchings to be made with structurally representative test vehicles means had to be found to reduce the shock of impact with the water, or eliminate it entirely, since the latter is not part of the design case.

Recovery of genuine Polaris-type airframes could have been achieved by a variety of arrangements, and the original idea



1957 *On September 27 the first "boilerplate" dummy was launched at Hunters Point during Operation Peashooter*

POLARIS . . .

initiated under Project Skyhook (a land-based project) was that the missile should be tethered by steel cables passed over rollers carried atop triangulated tower structures on either side of the launch tube. Towards apogee the missile would pull the cables taut, deceleration then being assisted by a snubbing device. By controlling the loads on the cables the missile would then be allowed to fall back but prevented from hitting the ground. In the event, however, Skyhook was superseded by Skycatch, which became a reality towards the end of 1958. Located at San Francisco Navy Yard, the system involves the use of that dockyard's largest travelling crane. To the top of its structure were attached hydraulic snubbing units modified from carrier arresting installations. Unpowered test vehicles were fired from a launch tube, while tethered by cables to these arresting units. As the missile rose into the air the cables were reeled in so that the missile eventually came to rest high above the ground; the missile was then lowered gently and recovered. By this means structurally representative and fully instrumented airframes were evaluated during the actual departure from the tube.

In order to conduct similar tests during underwater launchings a rig had to be designed and built from scratch. The US Navy Yard at Long Beach built a barge 100ft square, on which was mounted a crane derrick towering 186ft above the water and 100ft out from the barge gunwale. The cable from the barge was attached to the test vehicle through a detachable nosecap in a manner which did not affect the hydrodynamic behaviour of the missile, the actual anchorage being made through a shock-absorbing mechanism. Under the code-name of Fishhook, the rig was stationed at San Clemente Island and went into operation on April 24, 1959. As in the Skycatch programme, the cable attached to the rising missile was reeled in by a hydraulic ram and multiplying cable system.

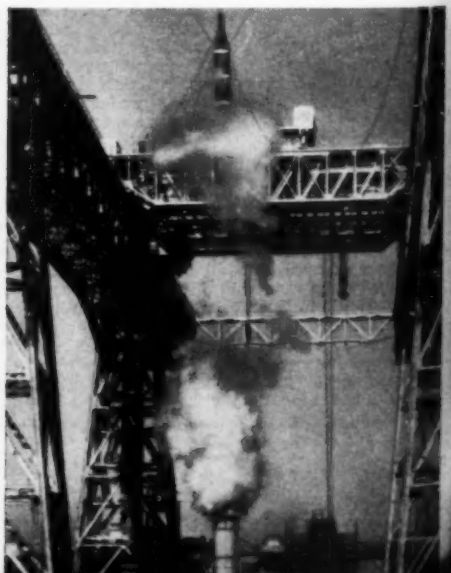
During the summer of 1958 Lockheed began to deliver flyable test vehicles almost indistinguishable from the operational Polaris, and incorporating all the airborne components which had been developed up to that time. The first series were designated AX-1, AX-2, *et seq*. Each was instrumented to yield information in particular areas, and although the series was fired in approximately numerical order, the sequence was sometimes upset by sudden requirements for a particular set of test results which could best be obtained by a particular member of the AX family.

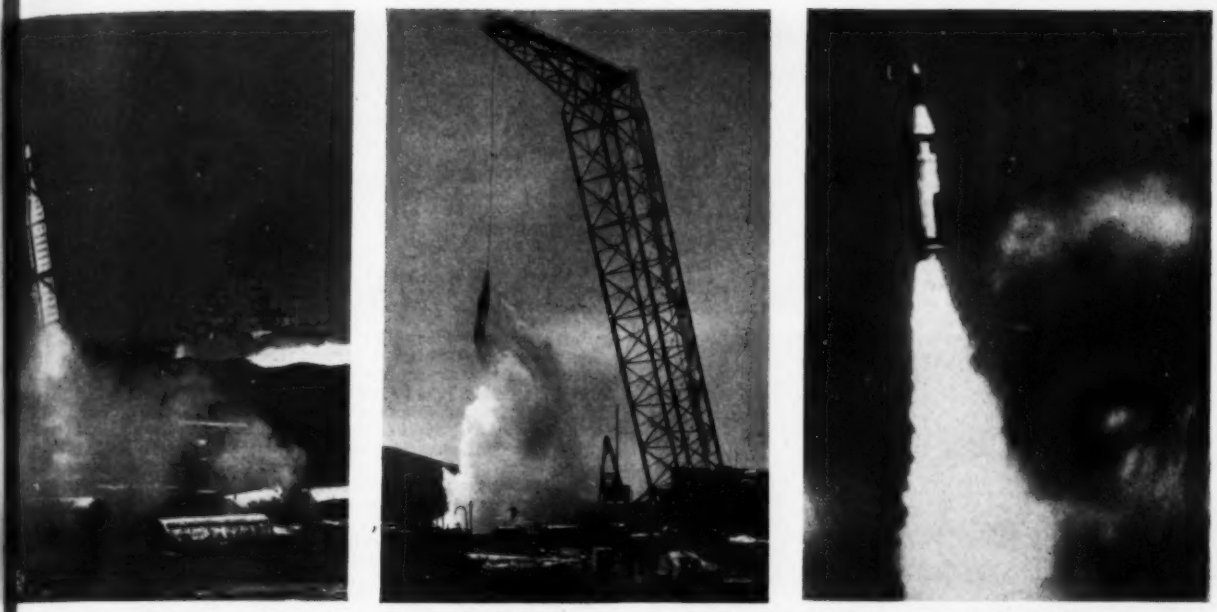
Static testing of the AX vehicles began at Santa Cruz, California, and AX-1 was fired from Cape Canaveral in September 1958. In the words of Admiral Raborn, "We expected more problems in this phase than we had experienced in development of the missile sub-systems. We knew, however, that basic design of the individual sub-systems had been proven, and that any problems unearthed would be susceptible to straightforward engineering solutions."

In fact, no particularly serious difficulty was encountered. The first flights were concerned with first-stage ignition, thrust and flight control, second-stage ignition, inter-stage and re-entry body separation, re-entry confirmation, and operation of the guidance system in a flight environment. Dramatic proof of the quality of the airborne components was obtained during the flight of AX-12, fired on July 15, 1959. One of the primary purposes of AX-12 was to test the airborne guidance computer. On take-off the missile lost part of a jetevator—something which had never previously happened—and the subsequent aerobatic behaviour established test conditions well outside the design limits. The performance of the airborne guidance system in this highly adverse environment was so outstanding that its remaining development schedule was foreshortened.

While the flight-test programme proved the flyable portions of the FBM system, the immense navigational problems were tackled with the aid of USS *Compass Island* (EAG-153), an 18,000-ton cargo ship rebuilt for this purpose and recommissioned in November 1956. The conversion included the installation of the complete ship's inertial navigation system, and *Compass Island* has now completed three years at sea in the perfection of all the non-airborne navigational equipment. A sister ship, USS *Observation Island* (EAG-154) has been equipped with most of the shipborne portions of the weapon system, including a launch tube projecting through the main deck near the starboard quarter. On August 14, 1959, an AX was successfully launched from Cape Canaveral Pad 25B (the ship simulator) under conditions repre-

1958 *Early in the year "Polaris jig" test vehicles were being launched at Cape Canaveral (left); on September 24 there was launched from the same complex the first vehicle of Polaris configuration (AX-1, middle picture); and the third photograph, taken on November 12, shows a launching under Operation Skycatch, with a structurally representative airframe nearing apogee after launching*





1959 *The left-hand photograph was taken on May 14, showing a missile at San Clemente leaving the water obliquely through waves generated by the cruiser seen in the background; on May 29 the middle photograph was secured during one of the Fishhook launchings; and the third photograph illustrates the first firing from the ship-motion simulator at Cape Canaveral, which took place on August 14*

sentative of a submarine in a heavy sea. Thirteen days later another AX was successfully launched from *Observation Island* off the Cape, and again all test objectives were met.

At the beginning of this year several major hurdles remained to be surmounted, and each was successfully overcome. Two new pads, 29A and 29B, were commissioned at the Cape and a new series of test vehicles, known as the A1X model, has been fired to solve the remaining problems preparatory to the achievement of initial operational capability. The A1X vehicles are externally similar to their predecessors, and differ only in slight improvements to the second-stage propulsion and the guidance system.

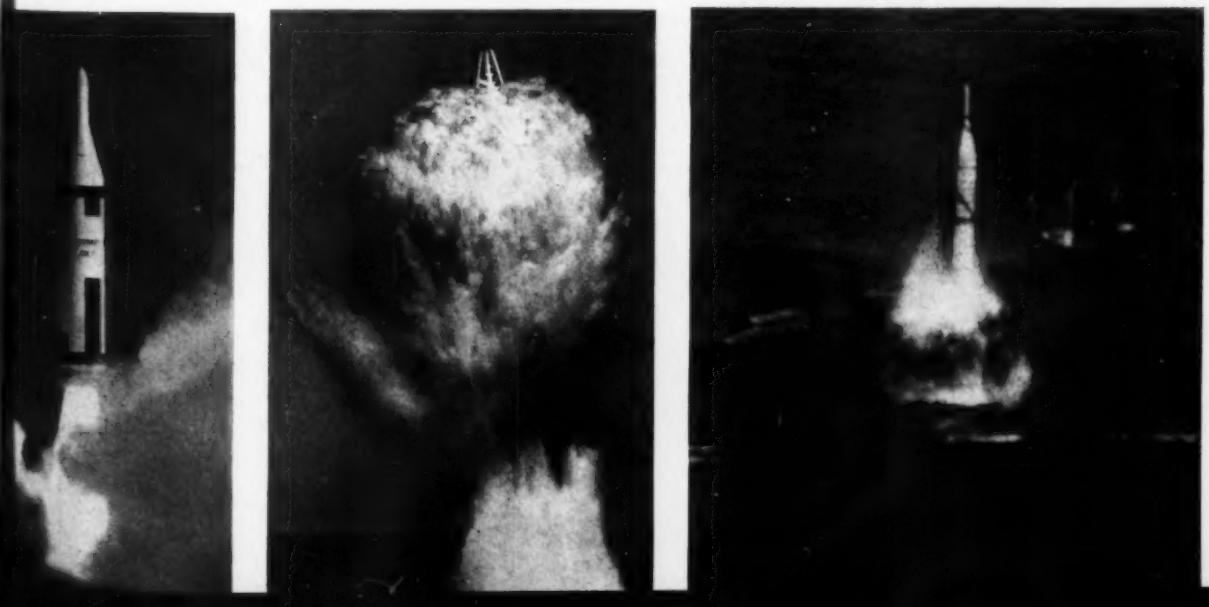
The first night firing (from Pad 25A) came on December 15, although a daytime launch on December 30 resulted in destruction by the range safety officer. By February 10, six consecutive test vehicles had flown 900 miles down the Atlantic Missile Range, all impacting in the target area. On February 26, a fully-guided round was fired from the ship simulator and the following day a successful re-entry test was made. On March 28 the first propelled missile to be fired from an underwater tube broke surface at San Clemente, but an automatic cutoff prevented ignition of the small amount of propellant in the first stage. The following day a fully guided A1X was successfully launched 900 miles down the Atlantic range from *Observation Island*. A major advance was successful ignition following an underwater launching, achieved at San Clemente on April 14; the first stage burnt for 5sec and the missile was recovered from an apogee of 1,800ft. First flight of over 1,000 miles was made from Cape Canaveral on April 25.

A re-usable Polaris, devoid of propulsion, is being employed in the checkout of submarine launch tubes and in the training of crews. Named Dolphin, the device is approximately the same size and weight as the operational missile, but differs greatly internally. Its backbone is a 25ft tube (which in all Dolphins so far delivered started life as a 16in-gun barrel-liner intended for *Missouri*-class battleships) charged with air at high pressure. After pneumatic launching from the submarine, the air in the central tube is ported to the base of the missile body to expel some 14,000lb of water in a forwards direction. This transfer of momentum halts the missile at, or only just above, the surface, and the empty Dolphin floats.

Keeping step with the missile's development, the FBM submarines are being commissioned at the rate of three a year. At present nine have been ordered. The first batch, SBB(N)598 *et seq*, carry 16 missiles each and have a surface displacement of 5,400 tons. The next class, beginning with SSB(N)608, have an additional hull bay and certain major improvements, and a third generation, SSB(N)616 onwards, will incorporate additional refinements.

[*Continued overleaf*

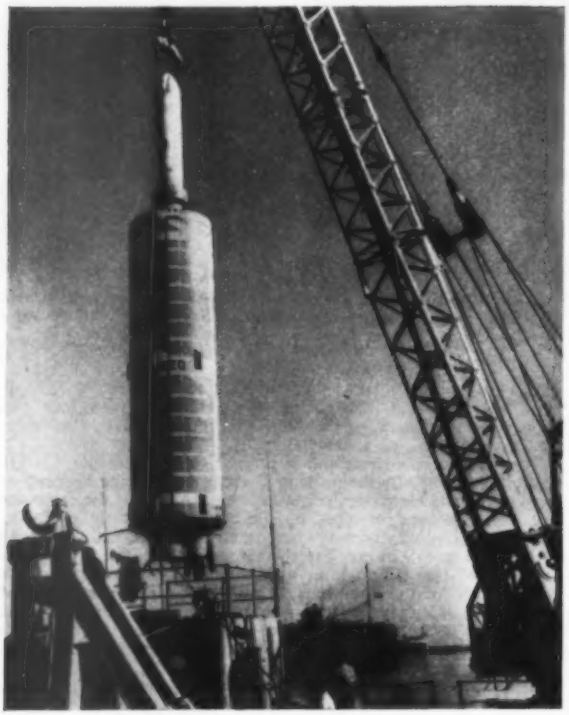
1960 *On January 22 Missile A1X-10 was fired from Pad 29B at Cape Canaveral (left); a Dolphin was tested on March 25, and on April 14 Lockheed achieved the first light-up of first-stage propulsion after a launching from beneath the surface of the ocean. Depicted in the third illustration, this ignition was achieved very close to the water surface, with the missile rising vertically*



POLARIS . . .

On the right is a recent aerial view of SSB(N)599 "Patrick Henry," surfaced somewhere in the Atlantic Ocean

Below is seen one of the Dolphin training vehicles, which, although having the same launch characteristics as Polaris, are less attractive in appearance



At the start of the Polaris programme it was hoped that an FBM submarine could put to sea some time after 1963. However, as the immense value of the concept became appreciated, its rate of funding was increased and the whole programme was greatly accelerated until in December 1957 the date for initial operational capability of SSB(N)598 was advanced to September 30, 1960. That this amazing schedule will be met seems certain. All this year *George Washington* has been working-up in the Atlantic, and she has already proved herself uncannily elusive. Numerous test slugs and Dolphins have checked out her tubes, and the culmination of her long working-up programme was the successful full-range flight of two Polaris from her tubes while submerged on July 20 (see news pages of this issue).

Since December 1956 the total appropriation chargeable against the FBM programme is approximately $2,742,650,000. At the end of March, the US Navy injected $52m (included in the above) to accelerate the commissioning dates of SSB(N)598-609 in order to "help close the missile gap" which would have existed between September 1960 and March 1962 when these ships were originally to have entered service. Some $16m of this sum is being spent on extra work shifts on the seven ships concerned. The acceleration was made possible by the excellent performance of the A1X missiles, nine out of the final ten having achieved all test objectives. Next year's budget is likely to include $975m for six additional submarines similar to SSB(N) 616. Eventually the Navy hopes to commission these craft at the rate of one a month until 45 are in service. (On the other hand, the Air Force are rather jealous of the FBM system, and have not been backward in suggesting that too much of the nation's deterrent strength should not be invested in it.)

Current production Polaris missiles have a range of 1,200nm. Present plans call for the production range to reach 1,500nm in 1962, and unofficial reports suggest that 2,500nm is theoretically possible by the addition of not more than 3ft to the length of the missile. Thus in three years' time the US Navy should have some 720 of these 0.5MT weapons capable of being fired from international waters to virtually any point on the Earth's surface. At any given time about half would be on-station and ready to fire.

On April 15 the US State Department confirmed that discussions between the USA and NATO countries were aimed at the deployment of large numbers of Polaris missiles in mobile land installations in various parts of Europe. It is no secret that Gen Norstad is anxious for Polaris to be deployed in Europe not later than 1963, and at the time of writing such a schedule should be met with ease. A political storm was created on July 4 by the US Army Secretary's assertion that the West German Defence Minister was "interested" in having the Bundeswehr equipped with a land-based Polaris. No such proposal has yet come before the NATO Council, but the British Prime Minister recently suggested that strategic missiles of this type would be in NATO service "in five or six years."

At present, however, the United Kingdom appears to be somewhat lukewarm over this proposal and has instead instituted "an urgent study" of the requirements for British-built submarines capable of carrying Polaris. The US Defense Department has stated that the missile could be purchased by Britain, but has not concealed the hope that we will fall into line with the proposal that these weapons should be managed by NATO. In any case it is quite clear that we have little thought of having an operational FBM submarine until 1970, by which time *George Washington* will have been in service for ten years.

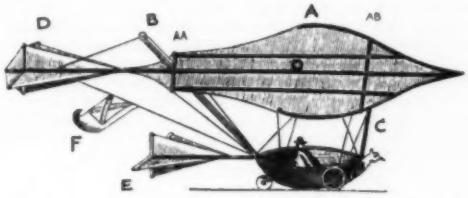
At Lockheed's Sunnyvale Plant is the pressure-tight tank (left) mentioned on page 147. In the interior view of the tank, taken during a visit by a British mission last month, are seen (left to right) Robert Kermeen, LMSD underwater-launch manager; Rear Admiral W. F. Raborn; Sir Solly Zuckerman, Scientific Adviser to the British Minister of Defence; the Minister, Harold Watkinson; Herschel J. Brown, LMSD general manager; and RAF officers who accompanied Mr Watkinson

The First Man-carrying Aeroplane

NEW LIGHT ON SIR GEORGE CAYLEY'S GLIDER OF 1852 **BY CHARLES H. GIBBS-SMITH**

I HAVE just had a once-in-a-lifetime stroke of good fortune. By a chain of almost uncanny accidents too long to detail here, I have stumbled across a full description and drawings of the first man-carrying aeroplane of history, Sir George Cayley's full-size glider of 1852-53. This treasure trove had lain unrecognized for over a century in the issue of the *Mechanics' Magazine* dated September 25, 1852, where an illustrated letter from Cayley appeared, dated September 15, from Brompton (near Scarborough). This letter (of which more later) was entitled "Sir George Cayley's Governable Parachutes." But first we must go back.

Thanks to the researches of the late J. E. Hodgson, and of Captain L. Laurence Pritchard, Cayley has been accorded international recognition as the true inventor of the modern aeroplane, "le véritable inventeur de l'aéroplane" as Charles Dollfus puts it. Capt Pritchard has recently completed his monumental life of Cayley (to be published next year) which will at last display Cayley to the world in all his brilliance. Capt Pritchard has also sorted out the Cayley chronology; detailed his various model gliders; has shown that a ten-year-old boy was (in Cayley's words) "floated



Figs 1 and (below) 2. Perspective sketch and plan view of the 1852-53 glider published with Cayley's letter of September 15, 1852

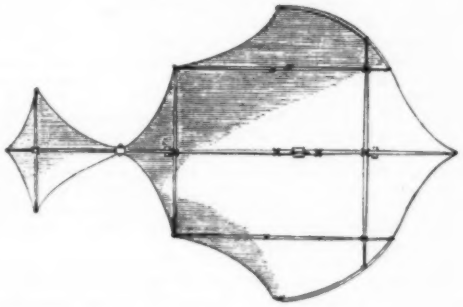
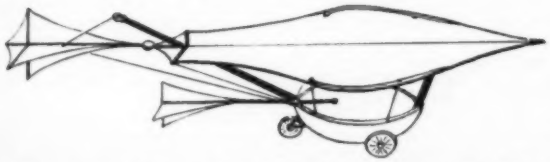


Fig 3. Perspective sketch, by the author of this article, based on Cayley's two drawings of the 1852-53 glider



off the ground for several yards" on two occasions in 1849 in a large "model" glider; and, finally, has established that in 1852 (or possibly 1853) Cayley—now nearing 80—built a full-size man-carrying glider and sent his unwilling coachman to fly in it.

Cayley's granddaughter witnessed this famous flight, and remembered "a large machine being started on the high side of the valley behind Brompton Hall . . . and the coachman being sent up in it, and it flew across the little valley, about 500 yards at most." After he had emerged from the machine, which "came down with a smash," the poor man cried: "Please, Sir George, I wish to give notice. I was hired to drive, not to fly." The witness, many years later, gave the date as 1852, but it is possible that it was the year after (see below).

I had my first piece of "Cayley luck" a short time back when I found a second contemporary indication of this glider in an

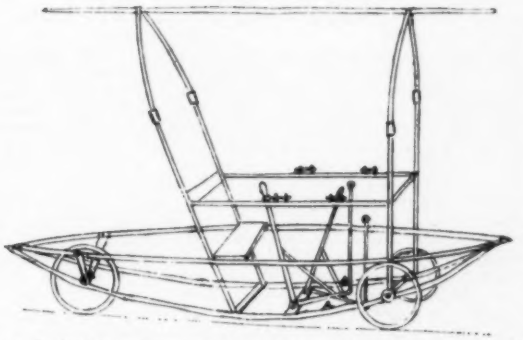


Fig 4. Cayley's later drawing (1853) of the nacelle of his full-size glider, now published for the first time. Various control levers have been included, the functions of which are not clear today

obscure entry in a volume of the *Encyclopaedia Britannica* published in 1855. The author, not realizing that fixed-wing gliding was a necessary preliminary to powered flight, wrote:—

"The flying apparatus constructed by Sir George Cayley can scarcely be considered as a successful experiment, since the wings acted rather on the principle of the parachute, merely floating the experimenter, who started from a moderate elevation, by a very gradual descent towards the earth."

There could be no better description of gliding flight, and it shows that some of Cayley's contemporaries were aware of what he was doing, although ignorant of the true significance of the events they recorded.

Although we have long known, from Cayley's notebook sketches, the configuration of some of his model gliders (especially those of 1804 and 1849), his most important machine—the documented first full-size man-carrying glider in history—remained a mystery, and hence a most tantalizing question mark for historians. It is this all-important missing link that has now come to light.

It is curious that the reason for his writing to the *Mechanics' Magazine* was a controversy about parachutes (the first live drop from the air had been in 1797) in which he said that a glider, instead of a conventional parachute, released from a balloon could not only be steered but flown to a distance "about five to six times the distance horizontally that the balloon is then above the earth." He says later that:—

". . . although the safe descent and steerage of such aerial vehicles has been abundantly proved, when properly adjusted, by their being launched from hill-tops into the valleys below, loaded up to a pound weight to the square foot of surface; yet no human lives should be put to hazard in these parachutes until a considerable series of descents have been made safely with dead weights exceeding that of the person wishing to try the experiment."

The two relevant illustrations published with Cayley's letter are reproduced here: Fig 1 is the original crude perspective woodcut; Fig 2 is the plan-form as given with the letter. Fig 3 is a sketch I have made—not taking into account Fig 4, of which more anon—to suggest a more realistic idea of the machine's appearance.

Owing to the small size of the letters on the original woodcut in Fig 1, I have re-lettered it. The glider consisted of a kite-form wing A of 476 sq ft of light cloth or silk, with a main centre-section rib (to be a tapering box girder of fir) secured to the nacelle by two struts B and C, and braced with wires. The nacelle is fitted with a tricycle undercarriage, the wheels being modern-type cycle wheels. The wing was given a dihedral angle, on either side of the rib, of 8° this angle being fixed by two vee-shaped spars AA and AB which in Fig 1 are "represented as being straight, for the purpose of not confusing the perspective." This dihedral, says Cayley, "tends powerfully to right the parachute in all cases of accidental disturbance."

Automatic longitudinal stability is achieved by a variable-incidence tailplane-cum-fin D which is adjusted and then fixed by means of two wires descending to the nacelle, one of which passes through an eye in the top of the extended strut B; the other (from which also hangs a flag F) runs direct to the nacelle. This tail unit "gives the most steady and secure course when slightly elevated, which also tends to secure the parachute from pitching, should it be exposed to an eddy of wind, and, together with the weight of the car, immediately restores the horizontal position." Here is automatic stability in practice nearly 20 years before Pénaud!

The First Man-carrying Aeroplane . . .

Control in the air, if the craft was actively piloted, was to be by the cruciform elevator-cum-rudder E, hinged to the back of the nacelle and worked by a lever; this was "sufficient to effect at will the steerage of the parachute, and to elevate or depress its course when occasion requires, or preparatory to alighting on the ground." This last is an interesting point to find considered in 1852.

The weight of the glider was about 150lb and "with the aeronaut, say 300lb"; the surface, including the tailplane, was about 500 sq ft, which gives a wing-loading of some 9.6oz/sq ft. "The centre of gravity of the car and its load must be so much in advance of the centre of resistance of the main sail as will incline it downward in front in an angle of 5° or 6° with the horizon. . . . Its angular velocity may be taken at about 30ft per second."

Mrs Thompson, Cayley's granddaughter, had very clear memories of the coachman's flight, but I have a feeling that her recollection of the date may be a year out, and that 1853 may be the correct date. I base this suggestion on the words Cayley used about the necessity of making careful tests in ballast, without mentioning the coachman's flight (although he may well have made other man-carrying tests as well); on the probability of unsuitable weather in the autumn and winter; and, finally, on his remarks in the June following (in a communication to a French learned society) implying that he was intending to experiment further with gliders. The summer of 1853 would, I think, be a fair guess for the date of the coachman's trip.

We cannot know, of course, the detailed configuration of the actual machine; but from the account of its behaviour, the description of the controls and of the general configuration—and bearing in mind that at the age of 79 Cayley would have fairly certainly finalized a vehicle about which he had done so much research—there can be little doubt that it followed the drawings he published. A most interesting corroboration of the nacelle shape has been discovered by Capt Pritchard among the Cayley papers in the form of beautifully rendered drawings; a reproduction (Fig 4, previous page) of one of these is here published for the first time, thanks to Capt Pritchard. This prophetic drawing was made by Cayley at some time before June 22, 1853, when it was done to accompany an article he had written for a French journal.

It does not take much knowledge of aviation history to appreciate the sheer brilliance—I repeat the word advisedly—of Cayley's design. But an extraordinary problem is set us when we ask why such an explicit and practical design was not immediately seized upon and exploited. The *Mechanics' Magazine* was certainly well known to inventors at the time, yet there is no evidence of any effort to emulate Cayley. The reason, like so many in history, is probably a complex amalgam of reasons. Perhaps the main factor in the design passing unnoticed until now was that no one in England until Wenham (about 1857-58) was really concerned with actual flying experiments; and certainly the practical problems of control, with which Cayley was also concerned, would seem almost chimerical to the earth-bound thinkers of the time. Even Wenham was more concerned with theoretical aerodynamics than with practical flying, and the only man who would at once have appreciated Cayley's work was Le Bris in France (1856-68) who was also the one man in aviation least likely to see or hear about the *Mechanics' Magazine*, as he was working in isolation in provincial France.

Cayley was so far in advance of his generation, especially in his balanced concern with both aerodynamics and practical pilotage—characteristics which were not to be properly married until Lilienthal in 1891-96—that it is little wonder that such a sophisticated idea as the 1852 glider passed the world by, and was soon lost to view between the covers of dusty volumes.

I cannot do better than close with yet another quotation from this remarkable letter of 1852: "It need scarcely be further remarked," writes Cayley, "that were we in possession of a sufficiently light first mover to propel such vehicles by waftage, either on the screw principle or otherwise, with such power as to supply that force horizontally, which gravitation here supplies in the descent, mechanical aerial navigation would be at our command without further delay."

New ILS at London Airport

ON Nos 1 and 5 runways at London Airport, and on runways at Ringway, Prestwick, Renfrew, Zurich and Melsbroek, Standard Telephones and Cables are installing their new STAN 78 instrument landing system. As announced in *Flight* last week, when the equipment was illustrated (page 128), the first full installation—at London Airport—will shortly be operational on the 28R direction of No 1 runway, and by the end of August STAN 78 (STAN 7 is the localizer, STAN 8 the glidepath) will provide the instrument landing facility in both directions. Existing ILS on runway No 5 (10R/28L) will be replaced during the winter when the runway is withdrawn from service for extension. The new ILS should be fully operational, with main and stand-by systems, on a runway with more concrete and new lighting, by the end of March. Other STAN 78 ILS systems are at Hurn, where development trials have been conducted over the past year, and another single set will be installed at the MoA Signals Training Establishment at Bletchley. The Canadian Department of Transport also are said to be interested in purchasing up to 35 sets. Approximate price of a dual (main and stand-by) system, depending upon location, is about £37,000.

STAN 78 is said to be greatly superior to previous systems in respect of beam stability; it has also been designed for greater reliability and easier maintenance. It is based on an overlapping-beam system developed for the USAF by the International Telephone and Telegraph Corp (Standard Telephones and Cables' US parent) in 1954. This mobile equipment, MRN 78, was taken up by STC in March 1957 and from it was evolved the present static ILS system.

In the azimuth-guidance part of the system, the composite radiation pattern from the independent localizer antenna arrays consists of two signal zones from the main "course" array plus two signal zones from the smaller, stronger "clearance" array. These are modulated at 90c/s and 150c/s and lie on either side of the runway centre-line. Basic frequency of the two arrays varies by 9.5kc/s. The clearance array, which has a back course, provides navigational information through 360° and is available to lead the pilot on to the highly directional superimposed beam of the course transmitter.

STC's proposals for an anglicized version of the US military equipment were accepted by the MTCA in April 1957 and work was started at once on a prototype model. There are a number of modifications from the US design; in particular, a constant-impedance double-sideband mechanical modulator was developed which is less complex than the original and not subject to variations which may occur from the ageing or failure of valves. This particular refinement in the design is in line with the STC aim of offering improved reliability and simplified maintenance. To this end transistors are widely used and the number of thermionic valves has been reduced from 140 to 14. All controls are independent, so that a progressive adjustment procedure is possible.

The glidepath antenna is a null-reference system covering path slopes between 2° and 4° but where it is desirable equi-signal or a sideband-only antenna could be used. In STAN 8 two patterns modulated at 90c/s and 150c/s are radiated on a common frequency to produce equal signal zones above and below the localizer glidepath.

The target the company set themselves was to produce a highly stable and accurate system to finer limits than those currently stipulated by ICAO Annex 10. As a list of desirable features they proposed that (a) the approach path should have minimum deviations from a straight line; (b) the path should be independent of aircraft attitude; (c) there should be no undesirable radiations and (d) maintenance costs and the number of types of components and units should be kept low.

The first of these desiderata was met by reducing the ground area of illumination so that deflections of the approach path caused by fixed objects are very gradual. Course bends and perturbations are reduced by the extensive aerial array radiating an extremely narrow beam and the clearance radiation pattern has a field strength up to three times that of inescapable secondary lobes, thus effectively masking their reflections. Detail-design features have enabled the other requirements to be met to a degree which the company regard as "very satisfactory." In a year of testing of the prototype at Hurn Airport only three malfunctions have been recorded and the centre-line error near the runway threshold (12,000ft from the transmitter) is of the order of only 5ft. The glidepath is established to within 3sec.

Control units for STAN 78 are contained in a sunken building at the end of the runway adjacent to the localizer aerial arrays, but a comprehensive remote control and monitoring system is installed in the control tower. Features of the latter unit are a station-signal identity check, fault indicator lights, intercom to site, and an alarm bell which rings if the course beam exceeds a 0.1° error or if other faults occur. Because an aircraft passing over the system will give a transient interference, a 10sec delay has been arranged between an error developing and the ringing of the alarm. Changeover to the stand-by system is normally automatic in 30sec but a rapid changeover (in 5sec) can be initiated manually on the remote control.

Can the high stability and accuracy so far demonstrated by STAN 78 be utilized in place of leader cable for automatic landing? Standard Telephones say that they are "cautiously optimistic; it might be applicable." They say also that it is too early yet for predictions to be made. But it seems reasonable that, through BLEU, the MoA may evaluate the new ILS with blind landing possibilities in mind.

Straight and Level

I LITTLE thought when I wrote last week about perpetuating errors of military fact that I should be presented with such a glaring example as the following (perpetrated, I regret, by a distinguished Battle of Britain fighter pilot, equally distinguished as a journalist, writing in a famous London evening newspaper):

"Its [the Me109's] armament was formidable, as many of us were to discover. There was a cannon, firing explosive shells through the propeller hub. And there were four or six heavy machine-guns, of which two were mounted above the engine cowling."

The distinguished author will please write out one hundred times: (1) No Battle of Britain Me109 had a cannon firing through the propeller hub. (2) No Battle of Britain Me109 had four or six heavy machine guns, either in addition to, or instead of, cannon. (3) No Battle of Britain Me109 had six machine guns. (4) No Battle of Britain Me109 had heavy machine guns. (5) All Battle of Britain Me109s had one of two armament schemes—four rifle-bore machine guns or two of these and two cannon.

I can't imagine a brighter bevy of besoms than this one, symbolizing the same number of pilotless sorties (28 to save you counting) by a target Meteor, operated by Short Bros & Harland at Llanbedr. (Gert, as formation leader, just can't help showing off)

With the Compliments of The Editor
Fleet Air Arm Revue 1960

"Show a leg there, my hearties! You can't be in the FAA chorus-line for 1960 if that's the best you can do. We're on the swept-wing band-wagon now, and the stringbag days are over."—Thespian ideas prompted by this nice compliments slip received with a copy of the *Fleet Air Arm Review 1960*

● Since my comment three weeks ago on Ministerial evasion on the grounds of security, our leaders have been at it again. Hansard, July 11:

"Mr Harold Davies asked the Minister of Aviation how much has been spent on the development of each of the following missiles, namely, Thunderbird, Bloodhound, Firestreak, Blue Steel, Seacat, Seaslug, Blue Water and Black Knight; when these weapons [*sic*] will be ready; and what has been spent on development and purchase of the aircraft, Victor, Vulcan, TSR2, NA39, Lightning, Javelin, Scimitar and Sea Vixen respectively.

"Mr Rippon: It would not be in the public interest to give so much information on the progress of our weapon development programme."

Back to square one, Mr. Davies.

● Tex Johnston, a good friend of my colleagues, has for quite a while been one of the most famous test pilots in the world. As chief of flight test for Boeing he has logged 14,000hr, nearly all of it in big multi-engined aircraft. Bearing in mind Boeing's imminent preoccupation with the Dyna Soar manned hypersonic space glider, I have been wondering whether Tex would achieve the greatest of all "firsts" by being at the controls on the first launch. But this palm seems likely to go to somebody from NASA or the USAF, because Tex has just been appointed an assistant programme manager on this project. In his new assignment he will be responsible for design and test; but the company announcement carefully refrains from saying whether he will actually be required to drive it. Remembering Tex's barn-storming days, and the way he can roll a B-52, I have no doubt he would be game to try.

● As far as I can determine, the only real missile deterrents in the West are the Atlas ICBMs of Strategic Air Command, and SAC is putting them on to launchers as hard as it can. I was surprised therefore to see that the USAF have given one to the Smithsonian Institution in Washington. Plenty of dummy Atlas missiles have appeared at various State Fairs, dragster meets, World Congresses of Flight and similar junketings, but the Smithsonian's is real, from the tip of its GE Mk 2 nosecone to the nozzles of its Rocketdyne engines. It is just as if, instead of sending it to Woomera, we had given a Blue Steel to the Science Museum.

● No longer is a co-pilot in Transport Command aircraft the man who sits in the right-hand seat and says "undercarriage down and locked" or "flaps coming up." According to the definition I heard last week at one of the RAF flying training schools (where they clearly have the right line in sales talk), he is now "the executive vice-president in a million-pound concern."

● My thanks to "Aerius," writing in *The Log*, official journal of the British Air Line Pilots Association, for putting on record this latest mergerism: "A group of representatives of famous BAC firms whom I met in June in a foreign capital claimed that they never leave their offices without instructing their secretaries: 'If the boss phones, ask him his name.'"

ROGER BACON

Where were the boys of the Old Brigade on July 19? As my picture suggests, they were hurtling around in the cerulean aboard an RAF Comet. And what were the lads of the new brigade up to on the same day . . .?

THE LONG REACH

H GHTER AND BOMBER COMMANDS

The technique of in-flight refuelling, utilizing equipment developed by Flight Refuelling Ltd, is now a standard operational procedure in both Bomber and Fighter Commands. The smaller pictures show two Vickers-Armstrongs Valiant B(K).1 bombers practising the use of the equipment. On the left are some new pictures by Russell Adams of the same tanker Valiant (a development aircraft numbered WZ376 and stationed at Boscombe Down) refuelling a Gloster Javelin FAW.9 from Moreton Valence

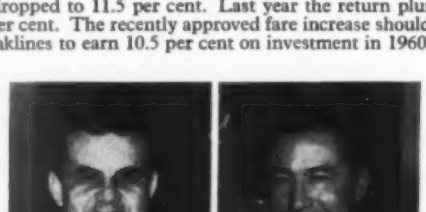
THE WOES of the US AIRLINES

By DON ADAMS (NEW YORK)

"There is a rising tide of resentment over the noise of the jets . . . the situation worsens daily"

ACCORDING to a growing number of editorials in leading American newspapers, US airlines are in the early stages of what most predict will be some very difficult times. Much of the industry troubles have been self induced; however, irrespective of who or what brought about the conditions, some solutions will soon have to be found for a series of major industry-wide problems.

Airline Costs and Fares The CAB recently (*Flight*, July 1960) granted the airlines a 2.5 per cent fare increase plus a further surcharge of $1 per one-way ticket. It is estimated that the airlines will realize approximately 5 per cent from this boost in fares. Most editorial comment had favoured even greater increases, but the CAB concluded that "full fare increases were not warranted in the light of all relevant data and the recently adopted regulatory standards." The 5 per cent allowed is substantially less than the 5.5 to 12 per cent cited by some airlines as the minimum amount they require to meet their present needs. Arguments in support of higher fares centred on the issue that air transport is government-regulated, and it was hence the responsibility of the governing powers to ensure that the operators realize a reasonable return on their investment. On a "return-on-investment" basis, the airlines earned some 12.3 per cent ten years ago. In 1955 this figure dropped to 11.5 per cent. Last year the return plummeted to 7.2 per cent. The recently approved fare increase should permit the trunklines to earn 10.5 per cent on investment in 1960. Based on total revenues, the airlines earned a 5.9 per cent profit ten years ago, 5.6 per cent in 1955 and 3.3 per cent last year.



Smiling here, Clarence B. Sayen, president of ALPA (left) and Elwood R. Quesada, FAA administrator, have had plenty of hard words in recent pilot v. Agency squabbles

The profit margins currently approved for two other government-regulated industries are 15 per cent (on revenues) for electric power, and 7.6 per cent (on revenues) for Class 1 railroads. These figures compare directly with the 3.3 per cent profit which the airlines earned in 1959.

Adequate profits had therefore been earned in the "pre-jet" days, but the introduction of large numbers of turbine-powered aircraft within the past 18 months has brought about a period of greatly increased costs and reduced revenues. At the end of 1959 the certificated airlines operated 1,894 aeroplanes, of which 84 were pure jets and 213 turboprops. During 1960 a further 155 pure jets and 54 turboprops will be delivered, so that by the end of the year America's airlines will be operating some 500 turbine-powered aircraft. More than 100 additional airliners are on order and will be put in service within the next two years. With only three of the twelve major trunk lines showing a profit during the first quarter of 1960, there are many who predict that the CAB fare-boost will simply be a case of "too little, too late."

Primary among what the airlines term "unexpected" costs have been enormously increased crew costs, the inability of the airlines to dispose of their piston-engined fleets at hoped-for sales prices, aircraft operating costs in excess of "brochure" costs, and the failure of air traffic to grow at previous rates. This latter problem means that the airlines have essentially over-bought. A variety of minor ills (such as the anti-noise measures imposed by some airport authorities) have contributed to industry woes. Very simply, the airliners are faced with the problem of having too many aircraft, all of which are very expensive to operate. And, of course, there is the problem of insufficient passenger traffic.

Labour Problems Since the introduction of the jets, the US Air Line Pilots Association has waged a series of vigorous battles, first against the airlines on the issue of crew salaries, and more recently against the Federal Aviation Agency. The airlines, caught in the middle of these skirmishes, have suffered accordingly. The latest ALPA struggle has concerned the question of whether FAA flight inspectors have the right to use the third-pilot seat on the flight decks of the big jets. Utilization of the seat by the FAA would be for the purpose of checking on pilot proficiency. The usually outspoken ALPA has been particularly vehement in its opposition to the proposal, contending that absence of the third pilot would be very detrimental to safety. There is little doubt that many pilots honestly believe that there is a question of safety involved; but virtually all neutral observers feel that the third pilot is simply a case of "featherbedding" (a term used in railroad parlance to denote that extra crew members are carried, not because they are needed, but simply to protect their jobs). It will be remembered that the pilots waged a long and bitter battle to win the right to have a third pilot, and many feel that once FAA inspectors occupy the seats without any obvious loss in safety the pilots' union may be at a disadvantage in future bargaining with the airlines.

The FAA/ALPA squabble is much deeper than the issue discussed above. Ever since Elwood R. Quesada was appointed chief of the agency he and the pilots have been engaged in a running feud. First, regulations concerning crew performance were tightened. Sloppy operations were met with heavy fines. To add to the bitter feelings, the FAA then passed a ruling grounding pilots who had reached a given age limit (60 for piston-engined operations, 55 for jet flights). Advancing the argument, founded on insurance statistics, that pilots in these age brackets—irrespective of their apparent good health—are more likely than younger men to suffer abrupt fatal attacks, the FAA ordered a number of older pilots out of the air. The numbers immediately affected were small, but in forthcoming years the effect must be increasingly felt. Generally, the public supports the government in this issue. Mr Quesada is frequently complimented for urging a much-needed tightening up in operations; but some feel that he could be a bit more diplomatic in his treatment of the pilots, who are a sensitive group.

Aircraft Noise Although there have been few headline incidents in America in recent months there is unquestionably a rising tide

THE WOES OF THE US AIRLINES . . .

of public discontentment over the noise of the jets. Little comfort is afforded the average citizen by the attempts of the airports to "minimize" noise. Nor is there any consolation in the fact that some groups have been able to prove that the noise of the jets is no greater than the noise of piston-powered aeroplanes. The plain matter of fact is that the jets are significantly more irritating to the public, and the situation worsens daily. What was several months ago an occasional nuisance is now a full-fledged annoyance. Public resentment is mounting, and unless some action is taken there is a possibility of measures being taken which will be extremely serious for the airlines. Discussed recently in New York was a bill which would alleviate the noise but limit take-off payload to a grossly uneconomic value.

Some promise has been held out for noise reductions when turbofan powerplants become available later this year; but now it is being suggested that the turbofans may be noisier than the present engines.

The Government's Responsibility As indicated earlier, much editorial abuse has been hurled at the government and their tardiness in granting a fare rise to the financially distressed airlines. Is this criticism justified? To answer this question it is necessary to review the government's role in the transport industry. First and foremost, it has the responsibility for protecting the *general* welfare. Logically, therefore, the federal agencies are charged with responsibility for assuring that flight operations are conducted with the highest possible degree of safety. Making certain that every single flight is a safe and uneventful journey is the prime function of the government regulatory powers. Next, the federal authorities should insure that passengers are not charged an unreasonable fare for the trip. These two points suggest that the government have the power to grant or deny certificates of airworthiness, and to establish a reasonable fare-structure. In general, government conduct in the execution of the former duty is without criticism. Today's aircraft are admirably safe, and there are few examples of fatalities caused by faulty design practice. But in regard to the fare structure few people seem to be satisfied with existing policy.

Why this should be so is difficult to understand. True enough, the recent fare increases were awarded only long after the need for action became evident; but an analysis of the underlying reasons which made the increase necessary must be made before the government's actions can be appropriately adjudged. In most passenger-fare discussions the airlines have taken on the air of an extremely aggrieved party. Their self-styled martyrs' role has them as the innocent victims of a series of unfortunate and unpredictable set of circumstances. To listen to airline pronouncements one would imagine that their lives are an endless series of battles with the FAA, the CAB, the ALPA, the airport authorities and others.

But how innocent are the airlines in reality, and how unpredictable were the present set of circumstances? An impartial survey of the current financial plight obviously reveals that jet-age costs are indeed higher than those of the piston era. The costs of every facet of jet operations are greater than comparable piston-engine transport costs. Yet few of these costs were truly "unpredictable." Impartial observers in the mid-1950s could have easily proved—as many did—that brochure costs for the big jets were highly optimistic. Predicted operating costs were too low, and the cost of all ancillary services were likewise viewed in too rosy a light. The airlines, however, chose to look at the optimistic side of the cost picture. They further erred in believing that traffic would continue to grow at the abnormally high rate evidenced at the end of the Korean War. The 1955-56 period, when most of the currently operating jets were ordered, was an extraordinarily favourable period in the American economy. More automobiles were marketed than ever before (or since). Interestingly enough, the car makers did not base future business activity on any optimistic rise in the long-term growth-rate. Strangely, however, the airlines did; they jumped full swing into the jet age and bought too many aeroplanes with too many seats. The airlines also erred in believing that they could sell their admittedly still airworthy piston fleets in a glutted used-aircraft market. They also chose to believe that aircraft noise would be acceptable, contrary to the opinions of most neutral observers.

The above may sound critical—as, of course, it is—but the point to be made is that the current crises are not completely the result of unforeseen events. Airline actions are not guided by some supernatural power. There was no mysterious hand which led the operators into today's nearly untenable position against their own will. A fair estimate would be that the airlines themselves must accept a great deal of the blame for their present predicament. This point is basic to the subject discussion, and is quite important in assessing the government's present actions. There is nothing in the government's sphere of responsibility which dictates that they must tolerate or reward mismanagement. The airline industry in America should be treated just like other businesses. There should be a chance of success, and a concurrent risk of failure. When a business is well run it should reap profits; but poorly run firms eventually must give way to better-managed ones. Since the government has the power to establish airline fares, they should judge those rates on the basis on which a well run airline can earn a reasonable profit. There should be no arbitrary ruling that *any* airline, simply because it is in the air transport business, should earn some specified profit irrespective of whether it is well run or grossly mismanaged. Inefficient managements should be forced out of the industry, just as they are in the remainder of the business world. The government's responsibility is to the people as a whole, and not to a special few in one industry.

"A fare structure should be established which eliminates the need for premature discarding of usable aircraft." Here are seen some highly usable piston-engined transports at Newark

Therefore, the government should strongly resist, as it has done, the requests for increased fares. Only those minimum fares required to enable well-run airlines to earn a reasonable profit should be awarded. And fare increases should not necessarily be granted solely to enable airlines to re-equip themselves year after year with the newest of aircraft. The airlines are in the business of carrying passengers, not of operating the most modern of available aircraft (unless by so doing they can carry more people at lower fares). The government's share of responsibility for the present crisis is that its fare policies foster among the airlines a necessity to continually buy ever-newer aircraft. A fare structure should be established which eliminates the need for premature discarding of usable aircraft. Obviously, such a course of action infers the establishment of fare differentials in line with the type of service offered. If fare differentials are in the interests of the general public—as it would appear they are—they should be permitted. Protecting the average individual, rather than some special interest, is the main responsibility of government.

The Future All of the above is a highly moralistic discourse on the ills of the industry. No immediate solutions are offered to a deeply distressed group of companies. Forgetting for the moment the issue of who, why or what brought about the troubles, some solutions are needed now before the entire industry, including the well run firms, is permitted to founder. One basic problem is that there are too many separate airlines, and for that reason the government should encourage mergers for the purpose of eliminating inefficiency and overlapping of services. Mergers have long been frowned upon by the anti-trust lawmakers in Washington, but some joining of firms now appears essential. According to a recent article in the *New York Journal American*, a number of mergers have been discussed. Included are American and Western, which would give American—already America's No 1 carrier—a very strong position on the west coast; United and Delta, and possibly all or part of Capital; Northwest and National; Braniff and Continental, and possibly Western or Capital as a third member; TWA and Northwest, which, after TWA's merger with Northeast (a foregone conclusion in America), would make TWA a really formidable domestic and international carrier; and Pan American and National—a merger which likely would be approved if TWA is allowed to merge with Northeast and Northwest. Whether or not these specific mergers are approved, it appears inevitable that some mergers will be allowed.

It has been further suggested, according to a report in *The Wall Street Journal*, that the CAB should expand its activities to include the regulation of departure and arrival times, the frequency of service between cities, and the types of aeroplanes which the airlines use. Nothing would be a greater mistake than for the government to assume such powers. Today's problems would be minor in comparison with those which such a move would bring about. As stated earlier, the official role should be to establish a framework within which the public interests are served and within which soundly managed firms can earn a reasonable profit. Nothing more is required to assure that the airlines enjoy an unprecedented boom.

FLIGHT SYSTEM SURVEY

Anticoustic Nosonic Headset on Trial

EARLY in May *Flight* received an Anticoustic Nosonic headset of the type illustrated here for trial in the Gemini regularly used for transport by the staff. Three pilots have since made many flights of between one and three hours' duration wearing this equipment, the longest time being six hours in three flights in two days.

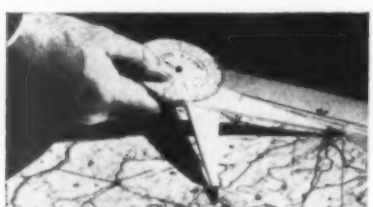
The headset as tested

The general opinion of the three is that the headset provided an enormous improvement in noise exclusion and microphone quality over the rather older equipment used before. Conversation in the Gemini is nearly impossible at cruising power and the use of a normal hand-held microphone is therefore aggravatingly difficult, but the Anticoustic boom microphone, adjustable to lie just beside the mouth, cancelled any aircraft noise and provided good speech transmission, which was always understood by controllers. The earphones were a little heavy and clamped rather firmly about the head; this would have been uncomfortable had it not been for the excellent fit and large size of the phones themselves. They could be twisted or slid up and down and had liquid-filled pads which made a comfortable fit very easy to achieve. Sound quality was so good that the rather high static background from the radio became obtrusive, to the exclusion of aircraft noise.

The headset costs £15 15s, complete with NATO or jack plugs, and can be obtained from the Anticoustic Co, Sussex House, 204 High Street, Guildford, Surrey.

Estimocompas DR Hand Computer

Now available in Britain is the ingenious French Estimocompas hand-held DR computer, which allows ready calculation of just about everything needed during normal cross-country flying in low-, medium- and high-performance aircraft. Basically it is a rotary slide rule, but it has in addition, as the picture shows, two calipers which can be used for direct measurement of distances,



The French Estimocompas, described on this page, showing the use of the calipers in making time/distance/speed calculations

groundspeeds and tracks from 1:500,000- and 1:1,000,000-scale maps. Speeds and distances are shown in both nautical and statute miles values.

The great advantage of this computer is that it can be held in one hand to make accurate measurement of distances on a map so that complete time/distance calculations can be performed. Clear and simple scales are also provided for wind angle, drift, groundspeed and sine and cosine calculations. True airspeed corrections according to pressure height and temperature and full conversions from metric to British values or nautical to statute miles can be made. Additional scales allow measurement of fuel consumption, endurance and duration of flight.

Measuring 7.3in long, and of 3in disc diameter, the computer is well constructed and smooth in operation. It is supplied in a strong plastic zipped holder and costs Nf68 in France. The price in England will be £5 5s. plus import duty, which has yet to be decided. UK agents are Tricolore Trading Co, 36 Southampton Street, London WC2

Flight has carried out the full range of calculations possible with the Estimocompas and found them clear and simple. The scales are well within the tolerances required for normal DR navigation, though not absolutely accurate. This is quite the best DR aid we have yet met for the average business or private pilot; its only drawback is that it is rather expensive.

Collins 618T SSB Radio

DELIVERIES are to begin in August of the new Collins 618T high-frequency single-sideband airborne radio. It covers the full 2 to 30Mc/s HF band in 1kc/s steps, providing 28,000 channels, and delivers 400W peak envelope power in SSB and a 100W carrier for AM operation. Phase-locking circuits are used to ensure accurate frequency-control in both reception and transmission so that additional frequency-control is unnecessary. Injections to the transmitter and receiver are locked by phase-comparison circuits to a single, highly accurate frequency standard.

All 28,000 channels are available at any time and a selector allows the use of upper or lower sideband or AM. A special audio output is provided to allow operation of conventional AM Selcal regardless of the setting of the selector. The 618T weighs 47lb and is enclosed in a 1ATR case.

Nova-Tech Lightweight Radio

ORIGINALLY designed specially for the Hughes 269A light two-seat helicopter, the Nova-Tech HR-1 VHF radio is now being offered for general sale and is distributed in this country by Helicopter Sales Ltd, 2 Lowndes Street, London SW1. Its price here is £255, duty paid.

The HR-1 has up to 23 crystal-controlled transmitter channels and a receiver covering the 108 to 130Mc/s band, which can be whistle-tuned to the transmitter. It weighs only 3lb 4oz, including a 12oz transistor power supply which may be adapted for 12V or

Nova-Tech HR-1 VHF radio for helicopters. It weighs only 3lb 4oz and has 23 transmitter channels

24V operation. Intercom is included. Power output is between 1.5 and 2W which, it is claimed, will allow a range of 100 miles over flat terrain and about 30 miles at 900ft. Nova-Tech also say that the equipment conforms to Federal Communications Commission acceptance specifications. Manufacturer's figures give amplitude modulation as 85 per cent, transmitter band-width as 4Mc/s, receiver band-width as 150Kc/s, a.g.c. in two stages and sensitivity as 3 microvolts.

Lear Artificial Horizons

AN $8m contract has been placed with Lear Inc by the USAF for 3in and 5in artificial horizons, respectively for fighters and bombers, incorporating a new malfunction warning system. The normal red warning flag will now emerge not only in case of a power failure but also after any failure in the servo loops. Both

Lear's new 2in miniature and 5in standard artificial horizons

these instruments are operated from remote attitude gyros. The company has also announced a miniature 2in standby artificial horizon operated from a remote gyro. This will have a 1.5:1 gearing to increase sensitivity in the pitch axis and electrical trim for both pitch and roll. The instrument includes two identical transistor amplifiers and can operate from DC or AC supplies. All three horizons have grey and black globes, graduated in degrees of climb and dive, moving behind a fixed aircraft silhouette.

Sport and Business

THE most exciting event of the month for the off-airways pilots is the limited issue by the Ministry of Aviation of a new publication, the *Light Aircraft Flight Guide*. Although restricted at present to two-score-odd experimental copies sent for comment to the Royal Aero Club, the Association of British Aero Clubs and Centres and the Popular Flying Association, *Flight Guide* follows quite closely the lines of the publication strongly advocated on these pages on December 11, 1959, *et seq*, and set out in considered detail on pages 414-415 of *Flight* of March 25, 1960.

What was said then was that "Although seeking to guide . . . the massive *Air Pilot* is out of sympathy with those who need a more simple directive. The obvious course is to separate, as other authorities have done already, the regulations controlling off-airways flying from those affecting aviation as a whole. If more responsibility is to be demanded of the private pilot his present responsibilities should be clarified. . . . A private pilot's *Air Pilot* is such a course."

Well, *Flight* and the many private pilots who foresaw a similar demand for a light aircraft guide (the cause has also been championed by the Royal Aero Club) look like getting from the Ministry what they have asked for: realistic guidance on flight safety in Great Britain's crowded air. In their introduction to the Guide the Ministry say that they are inviting critical comments on its contents and format so that they can assess the requirements for a future publication. The Guide has been compiled from pages extracted from *Air Pilot* and from those contained in the useful *Radio Facilities Charts*, and MoA say that this is a good way of keeping down the cost of production and facilitating amendments.

But there are also disadvantages in this system, as the Ministry are quick to recognize. The pages of *Air Pilot* contain data superfluous to the needs of the off-airways pilot and add unnecessarily to the problem of keeping the Guide amended. "One of the purposes of this experimental issue" say the Ministry, "is to obtain the reactions of users to this situation, and an indication of their methods of overcoming it in practice." And while it would be unfair in any way to condemn the Ministry's enterprise before using the guide for some months in the air, it is unfortunately only too true that pages selected from *Air Pilot* are unlikely to meet our real needs. With the ungraciousness of making a dental examination of a surprising and welcome gift horse, it must still be said that what is needed for the private pilot is the simplest possible publication requiring the absolute minimum of amendments. If they are Notams, for example, those that are applicable to *Light Aircraft Flight Guide* should carry some bold identification.

Briefly, the new volume is divided into sections covering aerodromes, communications, weather, safety and the air traffic service, each identified by the familiar abbreviations "AGA," "COM," "MET," "RAC" and "SAR"—an unnecessary affectation when plain language would do equally as well. But for a private pilot's bible the choice of subjects covered seems about right, although it might be said that there is too much information here for ready reference in the air. This gives point to a previous *Flight* proposal for a second, ultra-streamlined edition of a pilot's guide intended for ready reference in the cockpit.

This, it seems, should be the limit of our comment. The onus is now upon the selected recipients to distribute their copies wisely and to correlate the comment of their private pilot users. It is doubtful if a better opportunity has ever been presented for the three bodies concerned—the RAeC, the ABAC and PFA, to present their criticisms and suggestions to the Ministry in common accord. Is it too much to hope that *Light Aircraft Flight Guide* could be a unifying influence among these dissentient voices?

A. T. P.

DESIGNED BY FRITZ RAAB and demonstrated on the final day of the World Gliding Championships at Butzweiler last month, the Krähe powered sailplane illustrated right is the third of its type to be completed. Powered by a 16 h.p. Brändel engine, the aircraft has been constructed by J. Rock Segelflugzeugbau. Take-off at Butzweiler was by aerotow—by a Putzer Elster, another Raab design—but it is claimed that unassisted take-off is possible using the Brändel. More power would obviously give a better safety margin on take-off.

The unpowered version of the Krähe weighs 165kg empty, and the powered version 220kg. Payload is 120kg, giving a gross flying weight of 340kg. Under engine power its cruising speed is 90-95km/hr, and best gliding angle and best gliding speed were quoted as 1 in 20 and 65-70km/hr.

The Rock Krähe powered sailplane, demonstrated at Butzweiler and described above, is fitted with a 16 h.p. Brändel engine

FIVE AIR RACES will be held at Thruxton Aerodrome on Sunday, August 21, as part of a two-day At Home organized by the Wiltshire School of Flying. These will comprise a 58-mile closed triangular circuit for the Ladies' Handicap Race; class pylon races over a 22-mile circuit for Turbulents, Tiger Moths and Jackaroos respectively; and an open handicap race, again over the 58-mile triangle, the turning points for which are at Grove and Ramsbury.

Competitors are required to land at Thruxton not later than dusk on Saturday, August 20, and other visiting pilots by 1 p.m. on the Sunday. Entry forms are obtainable from the Wiltshire School of Flying at Thruxton; the six entries in each of the three class races will be decided on a "first come, first served" basis.

THE MINISTRY OF AVIATION and the Air Registration Board are developing simplified airworthiness requirements for the certification of light aircraft under 6,000lb in weight. This was stated in the House of Commons on July 11 by Geoffrey Rippon, Parliamentary Secretary to the Ministry.

RETROSPECT

From "Flight" of July 30, 1910

Rev. Sidney Swann Abandons Flying. After experimenting for twelve months with a monoplane of his own design, the Rev. Sidney Swann is said to have decided to give up the subject. His greatest success was a series of long hops of about 30 yards, and this was ended by charging into a grazing sheep with dire results to the latter.

An Aviator Fined for Damage. For having caused damage to a grass field, George Hammond was fined 2d. and costs at Consett on Tuesday. The defendant said he was flying a small aeroplane, and after a short distance in the air it dropped in the field, and the police caught him.

FIRST FLIGHT of the Astazou-powered Beech Travel Air was announced by the Sud-Aviation subsidiary SFERMA on July 19. The aircraft was flown by J. Lecarme with M. Alligier as second pilot and M. Sladek as test engineer.

HELICOPTERS in current use for business and executive work in the USA number 134, operated by 94 companies, according to a recent statement by W. L. Berry, assistant general manager of the aircraft division of Hughes Tool Co. There were 193 commercial helicopter operators with a total of 705 helicopters, he said, and 30 government agencies (other than the armed forces) operating 96 helicopters. "With realistic marketing programmes," he added, the helicopter market in the US, other than military and airline, should increase by a factor of 5-10.

A FOUR-SEATER VERSION of the two-seat CP.301C Emeraude is being constructed by Scintex Aviation. Known as the ML.145 Rubis, this aircraft will be powered by a 145 h.p. Continental engine and will have a retractable undercarriage, and was designed by the company's engineering department under the direction of Max de Lagrevol. Three prototypes are being built.

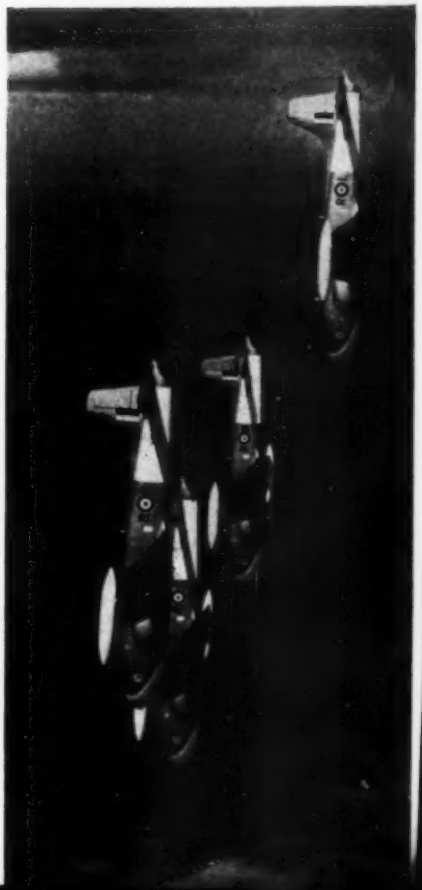
IN EARLY SEPTEMBER two undergraduates from Oxford and one from Cambridge will fly a hired Auster 5 across 14 countries to Katmandu, Nepal, and return. The aims of the flight include an investigation into the refugee problem in Nepal; a study of Nepalese government attitudes to India, China, communism and the frontier dispute; to prove that air touring is safe, economical and enjoyable; and "to extend the education of the expedition's members and to provide for them, quite unashamedly, some real adventure." The men involved are David Lomax, John Brown and Dermot Boyle, and they are at present trying to raise money—which should be sent to Mr Brown at Christ's College, Cambridge—to pay for the trip.

VARIETY AND VERVE

The composite formation above includes all types at the Central Flying School except Chipmunk and helicopters. Identifications of aircraft and pilots:— Anson T.19, Flt Lt J. S. Noonan; Canberra T.4, Flt Lt V. J. Nickson; Varsity T.1, Flt Lt G. Smythe; Jet Provost T.3, Plt Off B. A. D. Macdonald; Provost T.1, Fg Off R. W. Kimmings; Vampire T.11, Lt R. Wren, RN; Meteor T.7, Flt Lt D. H. Goodsir; Hunter F.4 (starboard), Flt Lt D. J. House; Hunter F.4 (port), Flt Lt T. A. Hastings

The CFS aerobatic team of Hunting Jet Provosts in the other pictures is composed of Flt Lts R. Langstaff and F. Brambley, Plt Off B. A. D. MacDonald and Flt Lt G. Nicklin

PHOTOGRAPHS BY RUSSELL ADAMS



Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

The Accident Record

THE news-item on page 39 of the issue of *Flight* dated July 8 which dealt with the 1960 accident record was most interesting. An investigation of our records shows that it is possible to add at least nine other accidents, tabulated below, to your list. Admittedly none of these entailed any fatalities to passengers; however, they did result in the deaths of ten people. This list is not conclusive as several other accidents which did not involve damage to property or severe damage to the aircraft have not been included.

Date	Carrier and Aircraft	Location	Fatalities	Circumstances
Jan 5	BEA Viscount	Malta	Nil	Collision with control tower (aircraft irreparably damaged)
Jan 7	BEA Viscount	London	Nil	Nosewheel collapsed on landing in thick fog. Fire damage extensive
Jan 21	BEA Viscount	Istanbul	Nil	Aircraft ran off runway
Feb 4	American Airlines(?) 707	St. Louis	Nil	Believed overshot runway
Feb 6	Skyways Auster	English Channel	2	Lost without trace, photographic charter
Feb 19	Aerolineas Comet	Buenos Aires	Nil	Heavy landing, extensive damage
Apr 20	Piedmont Airlines F-27 Private Cessna 310	Hickory N. Carolina	4	Collided in circuit area
May 9	TWA 707	Idlewild	Nil	Heavy landing after unsuccessful overshoot
May 23	Delta Airlines Convair 880	Atlanta, Georgia	4	Explosion on take-off, training flight

Your news-item pointed out that nearly half the accidents listed occurred in Latin America. This merely serves to highlight the stress laid by IFALPA in recent months on the inadequacies presently existing in the air traffic control services and in the provision of navigational aids in the South American sub-continent. That some form of action on the part of the authorities involved is needed cannot be denied, but how to encourage them to install these aids and implement the agreed services is the chief problem. For too long now too many promises have been made.

London W1 E. BOYLE,
Assistant Secretary (Technical), International Federation of Air Line Pilots Associations

[None of the accidents shown in Captain Boyle's list has been included in *Flight's* 1960 accident record because they do not fall into the category of accidents which occurred (a) on airline scheduled or non-scheduled service or (b) where fatalities occurred. Thus, for example, the Skyways Auster, and the Cessna 310 that was in collision with the Fairchild F-27, are not included, although in both cases occupants of the light aircraft were killed.—Ed.]

Lay that Pistol Down, Momma

BROWSING through old copies of *Flight* recently, I was interested to read in the issue of October 10, 1958, a letter from a reader whose wife frequently saw unidentifiable flying machines of revolutionary design. My mother has a similar ability.

Living near Greenham Common, B-47s are frequently seen by us, and the other day I saw, or thought I saw, three of them take off. However, in the afternoon I returned from school to be proudly informed by Mother that she had seen three aircraft take off from the base which, she declared, were "those Russian ones you were showing me pictures of." Tentative theories suggesting that the aircraft were of American manufacture were discarded with scorn; my mother "knows a B-47 when she sees one." My aircraft recognition obviously leaves much to be desired.

Should I impart the news of this Soviet invasion to the Minister of Defenc(s)e? Or perhaps M.I.5 are already on the job?

Newbury, Berks PATRICIA M. K. HAMMOND

U-2, Brute

"Melbourne, July 5.—The Americans were operating a U-2 spy plane from a base in Alice Springs, Peking declared tonight."

ABOUT two years ago the quiet and tranquil life of the Alice was disturbed by the sudden appearance in our midst, at the small Townsite Aerodrome, of a Canberra bomber. This wonder of the jet age had its day, and departed, and the life of the town settled back into the bull dust, spinifex and flies, and we were left alone to the world. [See "Cuckoo in the Nest," *Flight*, May 2, 1958.]

But now, as by an ICBM out of the blue, we have been pitched on to the international stage, with the news quoted above. How *could* they do such a thing? As it was, the news was broken to me by the retiring CO, Capt R. Evans, at a small party that we were giving him prior to his return to the States.

And so, dear friends, from the very fountain of misinformation, Peking no less, comes this startling information, that we here in the Alice have all unaware been harbouring a nest of vipers in our bosoms. Can it be that that howling in the early hours of the morning was not in fact the neighbour's cat, but a craftily concealed U-2 taking off on one of its dastardly missions? So *this* is the reason why Rosewalls are constructing that 8,000ft runway at the Seven-mile 'drome, and I had been thinking that it was purely being put there so that I might have a chance, one of these days, of having enough room to make a decent landing. What *is* one to believe? I read from a later report that there is a craftily concealed hut in the hill somewhere—all very top secret stuff. To this location I hurried; and my sketch (taken from the pouch of a passing kangaroo) shows this heavily guarded hut. Is this where they keep the U-2s? They also report that Australian workers have been blindfolded when taken to work on some of the top-secret equipment. The statement may be true, but the location is not, as most of these blind Aussies are ably supported by a chromium bar, and can be recognized by their call-sign "Your shout, Blue."

We of Connellan Airways here are justifiably perturbed of course, as we had fondly imagined that we were the only flying unit operating from the Alice. But now what is one to think? Perhaps we have an Olga Meinerzeitung in our midst, not to mention a secret radio to Peking. Perhaps it was "Them" who set fire to the Stuart Arms Hotel. I think I had better jump on board my trusty steed (exclusive sketch here) and away farther beyond the Black Stump; this place is getting too much in the limelight for health.

And there you have it, mates. And when, weighed down with gold braid and what not, you climb into your 707s and DC-8s and Comets and away into the pale blue yonder, just you remember, that here in the Centre at least we have a U too!

Alice Springs, NT, Australia G. E. C. ARCHER

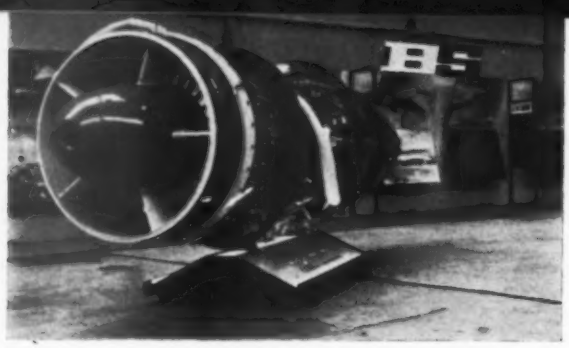
Ex-Luftwaffe Museum

HAVING noticed the photograph on page 78 of your issue of July 15, I should like to comment on the growing "World War 2 Flight" at Biggin Hill. A short time ago work was proceeding at RAF Colerne, Wilts, on two more aircraft intended for Biggin Hill—a Japanese Tojo and a Ju88C. There have also been two other ex-Luftwaffe machines at Colerne for several years, namely, a He162A (12027) and an Me163 Komet (25). This station is also proud to boast a genuine Battle of Britain Spitfire, which was given to them by a scrap merchant who had purchased it to break up.

Bristol 9 P. R. MARCH

FORTHCOMING EVENTS

July 23-Aug. 1. Inter-Services Gliding Championships, Odiham.
July 23-Aug. 1. RAF Inter-Command Gliding Championships, Odiham.
July 24-Aug. 1. Gliding Weeks: Yorkshire GC., Sutton Bank; London GC., Dunstable; Coventry GC., Edge Hill (opens July 23).
July 30-31. Rally, Netherthorpe, near Worksop.
Aug. 3. Kronfeld Club: Polish film of 1958 World Gliding Championships.
Aug. 7-17. Bulgarian Aero Club: World Parachuting Championships, Mousatcheva, near Sofia.
Aug. 10. Kronfeld Club: MTCA Air-miss film.
Aug. 14. Elstree Flying Club: Tea Patrol.
Aug. 17. Kronfeld Club: Talk on National Gliding Week.
Aug. 20-21. Pescara Aero Club Rally.
Aug. 21. Colman Aero Club: Alsace Wine Rally.
Aug. 27. Luton Flying Club Display, Luton Airport.
Aug. 28. Oxford Aeroplane Club At Home, Kidlington.
Aug. 28-Sept. 4. Czech Aero Club: World Aerobatic Championships.
Sept. 5-11. SBAC Display and Exhibition, Farnborough.



Keeping them in touch: with the object of giving employees at the various Bristol Siddeley factories a clear picture of current products and activities, an exhibition has been touring the Parkside and Ansty (Coventry), Sunderland and Patchway works. A section of the display, with an Olympus 104 in the foreground, is seen here

THE INDUSTRY

Rolls-Royce Board Appointment

THE appointment of Mr D. P. Huddie to the board of Rolls-Royce Ltd was announced last week. Mr Huddie joined the company in 1939 and his first appointment was in the design office stress section, of which he was eventually given charge.

In 1946 he was made an assistant chief designer and two years later was transferred to development work and given responsibility for the commercial version of the Merlin, at that time the only Rolls-Royce civil engine. From that time onwards he was almost exclusively concerned with civil-transport engines. He was in charge of the development of the Dart and of other civil engines of later design. Mr Huddie was appointed chief development engineer, civil engines, in 1952 and assistant chief engineer, civil engines, in 1956. In 1958 he was appointed general manager, sales and service, and was also made a director of the Aero Engine and International Divisions of the company.

"Wakefield" Becomes "Castrol"

FROM August 2, and subject to the formal approval of the Board of Trade, the firm of C. C. Wakefield & Co Ltd is to be known as Castrol Ltd.

Giving reasons for the change, the company explains that since the war its business has grown enormously. "With the post-war generation it is the name Castrol which has the greater significance. It is to simplify the work and the identity of the group as a whole that we have, with reluctance, decided to lay aside the 'family' name of which we have been so proud and go ahead under the title of our principal trademark. . . ."

The company was founded in 1899 by Charles Cheers Wakefield, later to become Viscount Wakefield of Hythe. Castrol motor oil made its appearance ten years later. Today the group of 24 companies is headed by Mr Leslie W. Farrow as chairman, with Mr Leonard M. Broadway as managing director.

A recent item of aeronautical news from the group is that the ARB and Rolls-Royce Ltd have given full approval for the use of Castrol 98 gas turbine lubricant in the Avon engine. This follows extensive laboratory and test-bed trials and a thousand hours' flying in Mk 522 Avons of Air France Caravelles.

Refuelling-Couplings Agreement

AN announcement by Armstrong Whitworth Equipment says that in conjunction with Avery-Hardoll Ltd they have completed the first stage of an agreement covering refuelling couplings for general aircraft use, and that Armstrong Whitworth sales promotion of these particular couplings has now ended.

"As a result," they state, "Avery-Hardoll will undertake again the sale of their refuelling couplings and, in consequence, no future orders will be accepted direct by Armstrong Whitworth Equipment. Avery-Hardoll wish to assure present customers of Armstrong Whitworth Equipment of a prompt and efficient service. All orders placed prior to July 31, 1960, will be fully completed by Armstrong Whitworth Equipment to prices and delivery dates quoted."

One Firm's War

SPEAKING at a recent luncheon in London's Guildhall to celebrate the 25th anniversary of Ultra Electric (founded in the City) Mr Edward E. Rosen, chairman of Ultra Electric (Holdings) Ltd, recalled the World War 2 years of the company.

"We already knew something about radar," he said, "so we naturally thought that we were going to be chosen to help this new secret device. Not on your life. In 1938 we were informed that we were going to make aeroplanes. We were brought into a team that made the Stirling bomber, and we made great big chunks of it—and thousands of them. We made the tail—and there was more work, more material, in the tail of a Stirling than there was in a Spitfire. We made the bomb doors; there were six of them, and they were 43ft 6in long when they were joined up.

"When the war actually broke out we were taken over completely and from then on wiser councils prevailed. We continued to do our stuff for the Stirling and for the Lancaster and for the Mosquito, in a very large way. We ran six factories at that time for the Government, but we also made other contributions of which we are very proud. We did ground work for anti-submarine warfare which, I believe, was pretty effective in helping the Navy and the Air Force in their overcoming Britain's almost greatest enemy, the U-boat. Our other contributions were that on practically every British aircraft that flew there was something of importance that was Ultra."

Mr Rosen went on to describe the company's present-day products, which include electronic engine controls; completion of a million passenger-carrying hours of these controls on the Proteus engines of Britannias was recently celebrated (*Flight*, May 6).

Flight Refuelling in France

WRITING in appreciation of our recent "France's Aircraft Industry" number, Flight Refuelling Ltd include a note on current use of their products in France. They hold the French licence for all Flight Refuelling ancillary equipment. Licence-made fuel-system equipment (non-return and shut-off valves, float switches, refuelling adaptors, etc.) is supplied by the French Zenith company for the Sud-Aviation Caravelle, Vautour and SE-3200 Frelon; Breguet 1050 Alizé; and Dassault Mirage III and IV, Etendard IVM and Super Mystère. Zenith, incidentally, also hold the Saunders Valve Company's licence for the Saunders spherical cock.

Goodyear-Equipped Vanguards

TYRES, wheels, brakes and anti-skid equipment of Goodyear manufacture have been specified for the 23 Vickers Vanguards ordered by Trans-Canada Air Lines. By special arrangement with TCA the wheels and brakes were manufactured by Goodyear in the USA, whilst the tyres and anti-skid equipment were supplied by the British company. After-sales service will be provided by Goodyear-Canada in conjunction with the US and British companies.

Other news from Goodyear is of the transfer of Mr W. U. Chapman, manager of the Industrial Products Department, to the Export Sales Division. He is succeeded by Mr J. T. Pearson, who served with the RAF during the war and (in Technical Training Command) for several years afterwards.

IN BRIEF

Dunlop Aviation Division are supplying tyres, wheels and brakes for the new German VEB.152 airliner.

Mr Geoffrey F. G. Hinings, general manager of Newton Brothers (Derby) Ltd, has been appointed a director of the company.

A bronchoscopy chair (for use in the visual examination of the interior of the bronchial tubes and respiratory passages) made by Dowty Group apprentices has been presented to Cheltenham General Hospital.

The Swedish Government has awarded Solartron Radar Simulators Ltd contracts totalling £200,000 for radar simulating systems. "These orders," state the company, "will take Solartron into new fields of simulating equipment."

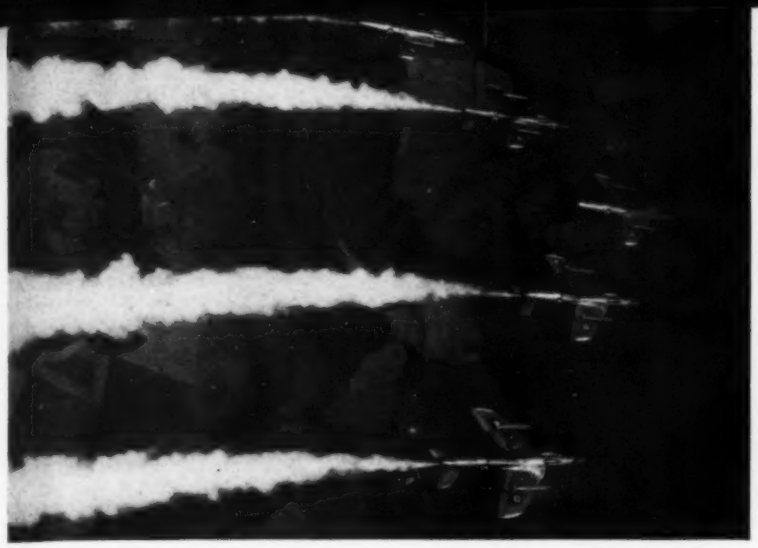
Indian-built Avro 748s are to be fitted with Marconi AD.722 sub-miniature DF. This equipment is being manufactured by Bharat Electronics Ltd in Bangalore, under a recent agreement between the Indian Government and Marconi's Wireless Telegraph Co Ltd.

Following the lifting of import restrictions, Honeywell Controls Ltd, of Greenford, Middx, have arranged with their US associates for the marketing of the Visicorder 14-channel direct-reading oscillograph, at a basic price of £750. Instruments will shortly be available from stock.

Palmer Aero Products have been awarded "a large contract" to supply three types of filter specially developed for the English Electric Lightning. All three are equipped with "Parmesh" stainless-steel elements for filtering DTD 585 hydraulic fluid.

Short Bros & Harland have chosen a twin 25-litre liquid-oxygen breathing system for the Britannic aircraft, and 11 sets of the equipment will be required. This follows an initial order placed with British Oxygen Aviation Services by AWA for 20 sets for the A.W.660. A filled 25-litre lox assembly weighs only 102lb.

The peripheral rotor of the Britten-Norman Cushioncraft (the vehicle was described in *Flight* for June 24) is made of laminated wood glued with "Cascophen" resorcinol resin glue. The rotor is also covered with "Cascover" sheathing by a process utilising specially woven and treated nylon cloth, resorcinol resin and a vinyl coating. Both glue and sheathing products are specialities of Leicester, Lovell & Co Ltd, of North Baddesley, Southampton.



Hawker Hunter F.6s of No 92 Sqn, which provides the Fighter Command reserve aerobatic team this year. The squadron is based at RAF Middleton St George and commanded by Sqn Ldr R. H. B. Dixon

SERVICE AVIATION

Air Force, Naval and Army Flying News

Air Staff Post

UNTIL recently AOC Hong Kong, AVM P. D. Holder has been appointed Assistant Chief of the Air Staff (Training) at Air Ministry. Before going to the Far East he took the 1956 IDC course, having previously (from 1953) held an Air Ministry post as Deputy Director of Policy (Air Staff). During the war he was a bomber pilot, commanding No 218 Sqn and winning the DSO and DFC.

Top Tribute

PAYING tribute to Treble-One Squadron in a foreword to a brochure on the squadron's aerobatic team published by Air Ministry the AOC-in-C Fighter Command, Air Marshal Sir Hector McGregor, writes: "As a past member of 'Treble-One' I am particularly pleased that the squadron is Fighter Command's leading aerobatic team for 1960. No 111 Sqn has thus been honoured for four years in succession. During this period it has given faultless displays of formation aerobatics in many countries and on many occasions. The excellence and precision of these displays amply demonstrate the accuracy, skill and confidence of the pilots."

The brochure, which is amply illustrated, contains an article on aerobatic manœuvres and training, a history of the squadron and biographical notes on its pilots. It has been prepared by the Information Division, Air Ministry, Whitehall, London SW1.

Malayan Operations

NEXT Sunday, July 31, the 12-year emergency in Malaya is due to come to an end. During those years squadrons of the RAF, RAAF and RNZAF have played an important part in operations. Four of the RAF squadrons have been operating with the Far East Air Force since the emergency began. Three of them, Nos 45 (Bomber), 60 (Fighter) and 81 (Photo/Reconnaissance) are based at RAF Tengah, Singapore; and the fourth, No 52 (Transport) at Kuala Lumpur in Malaya. A decisive role has been played by helicopters of No 110 Sqn and before it by those of Nos 155 and 194 Sqns. Transport aircraft—the Valettas and Pioneers of the RAF and Bristol Freighters of No 41 Sqn, RNZAF—have flown hundreds of missions and parachute-dropped 4m lb of supplies a year. Reference to psychological warfare by air-to-ground broadcasts was made on this page on July 15; and bombing operations have been carried out by Lincolns of the RAAF and—on a rotational basis—by Bomber Command squadrons, supported by Venom fighter bombers of the RNZAF and (at a later stage) by Canberras of Bomber Command. Though the emergency is ending, air-to-ground operations against the remnants of the terrorists are likely to continue for some time on a reduced scale.

AAC Museum

AT the Army Air Corps Centre, Middle Wallop, a permanent museum of Army flying is being set up. It will include "all aspects of Air OP and the Light Liaison Flights of the Glider Pilot Regiment," the period represented being from 1938 to the present day, with particular emphasis on the Second World War, the Korean War, the Malayan and Cyprus campaigns and the Suez landings.

Anyone willing to contribute documents, photographs or other exhibits—either on a loan or permanent basis—should contact Maj F. R. I. Gotaas, RA, Army Air Corps Centre, Middle Wallop, Stockbridge, Hants.

IN BRIEF

The Royal Ceylon Air Force is "fully prepared" to take over the Katunayake air base at the end of this month, according to the Commander-in-Chief, AVM J. L. Baker.

Past and present Fleet Air Arm officers who have not already done so are invited to join the Fleet Air Arm Officers' Association. Applications may be made to the Secretary, Fleet Air Arm Officers' Association, 94 Piccadilly, London W1.

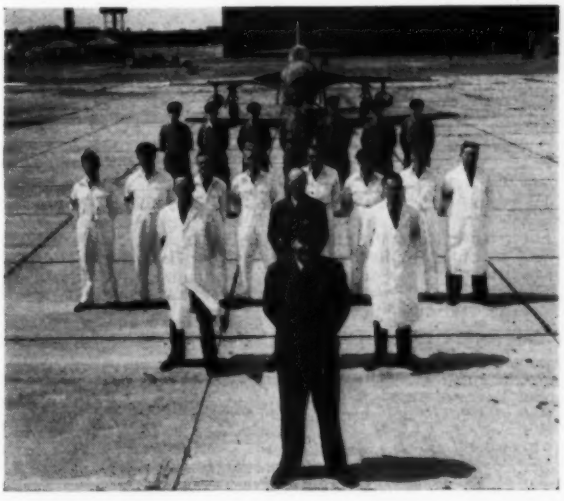
Gp Capt J. E. Innes-Crump, who since 1957 has been superintendent of the MoA air stations at Defford and Pershore in Worcestershire, has been appointed Director of Air Staff Briefing at Air Ministry with the acting rank of air commodore.

Beverleys of No 30 Sqn recently dropped 300 men of the 2nd Battalion, the Parachute Regiment, on a 6,000ft plateau in Kenya. The troops, who were accompanied by instructors from No 1 Parachute Training School at Abingdon, were dropped from a height of 1,000ft above the plateau. The rarefied atmosphere accelerated their rate of descent by 2-3ft/sec.

An RAAF team headed by the Chief of the Air Staff, Air Marshal Sir Frederick Scherger, has been visiting the Lockheed Aircraft Corporation headquarters to make an evaluation of the F-104 Starfighter. Ultimate choice of RAAF equipment—with which the future of Australia's aircraft industry is closely linked—has been the subject of articles (April 1 and June 10) by *Flight's* Australian correspondent.

ROC Days, when members of the Royal Observer Corps are entertained at RAF stations, are planned for August as follows: on the 6th, West Malling, Kent; and on the 14th, Duxford, Cambs, and Coltishall, Norfolk (with displays at all three stations by No 111 Sqn and at Coltishall by a CFS team). September venues are Leconfield, nr Beverley, Yorks (3rd); and St Athan, Glam (displays by No 92 Sqn); and Chivenor, Devon (25th).

Two Argentine Air Force prizes awarded annually to the RAF were presented by the Argentine Ambassador (HE Rear Admiral Teodor Hartung) at the RAF Technical College, Henlow, on July 18. The senior prize—a sword, awarded to the top cadet graduating from Cranwell or Halton—went to Plt Off Denis West (ex-Henlow); and the junior prize—a medal, going to the aircraft or administration apprentice passing out with the highest marks—was won by Tech Cdt David Green, formerly at Halton.



Ground crew and pilots of No 92 Sqn (see heading picture): Fg Off D. B. D. Rhodes, engineer officer; F/Sgt C. Rutter, WO H. W. Cooper and F/Sgt H. C. Webb; Cpl Tech A. Maxwell, Cpl M. Raine, Jnr Techs F. Askew and I. M. Aitken; SAC R. M. Harper, Cpl H. Gallagher, Jnr Tech J. H. Birkbeck and Sgt E. D. Wilson; Fg Offs B. Allchin and J. J. Seavers, Flt Lt G. L. Aylett; Sqn Ldr R. H. B. Dixon, Flt Lts B. E. St Clair and R. Carpenter, and Fg Off D. G. Gill

This was the scene at Ciampino Airport on July 19 when three Aeroflot Il-18s called at Rome on their way from Moscow to contribute to the United Nations air lift to the Congo. The operation goes on, with airlines, the RAF and the USAF contributing

AIR COMMERCE

BOAC's YEAR

YESTERDAY, July 28, Sir Gerard d'Erlanger performed his last duty as part-time chairman of BOAC: he presented the corporation's report and accounts for the year ended March 31, 1960. The new whole-time chairman, Sir Matthew Slattery, has already been acquainting himself with his new job, and his appointment is official as from today, July 29.

It is expected that the BOAC accounts will show a net 1959-60 profit for the parent corporation of about £¼ million, though this becomes a loss of rather more than £¾ million when BOAC Associated Companies' results are taken into account. These figures are rather better than the preliminary estimates (*Flight*, May 6). We hope to publish full reviews of the report and accounts in subsequent issues.

BEA's annual report is expected to be presented during the week beginning August 22.

THE LICENSING REGULATIONS

NOW being circulated within the aviation industry is a preliminary draft of the Regulations that will implement the Civil Aviation Licensing Act which received the Royal Assent on June 9. Comments should be sent to the Minister by September 16.

Except for the question of aerial advertising and of fees to be charged by the Air Transport Licensing Board, all outstanding points in the Act are covered in these draft Regulations, which are built up around the concept of six classes of licence.

Class A deals with scheduled services; Classes B, C and D deal with charter services; Class E deals with general services not between specified points (Classes A to D cover specific routes); and Class F is a sort of ministerial pig bin into which will go any types of service which don't belong anywhere else.

Interest is concentrated on Classes B, C and D, which embrace the various types of charter service—in particular Class D, which covers genuine group charter services. This category comprises (a) groups supported by voluntary contribution; (b) spontaneous groups (this virtually refers to flights organized privately on a non-profit basis); and (c) affinity groups in which all passengers must have belonged for at least six months to a *bona fide* organization with not less than 15,000 members. In this class the fares are not controlled except in so far that "the operator's reward" for carrying out flights for spontaneous groups shall not be less than the aggregate of the amounts paid by the passengers (i.e., leaving nothing for any middleman). In the case of Class C charters the Board may dispense with tariff provision. Other charter flights not coming under Classes C and D will come under Class B and in this case tariff will be controlled and—as with scheduled services under Class A—advertisement of applications and the conduct of hearings* will be the rule.

Much of the draft Regulations cover the precise form to be followed in making application for representation to the Board. Three particularly important points emerge: (1) The Board will issue a regular publication, *Civil Aviation Licensing Notices*, in which will be given full details of its activities and its decisions; (2) all holders of licences will be required to furnish "statistical, financial and other information" in respect of their operations; (3) parties aggrieved by the Board's decision may appeal to the Minister who, in turn, will appoint a commissioner to hold public hearings and then report back to him. The Minister's decision will then take the form of an order to the Board, which will be required to carry out his instructions and to publish both the commissioner's report and the Minister's order.

**The Regulations confirm that "every hearing shall be held in public unless the Board shall otherwise decide."*

SUPERSONIC STATEMENT

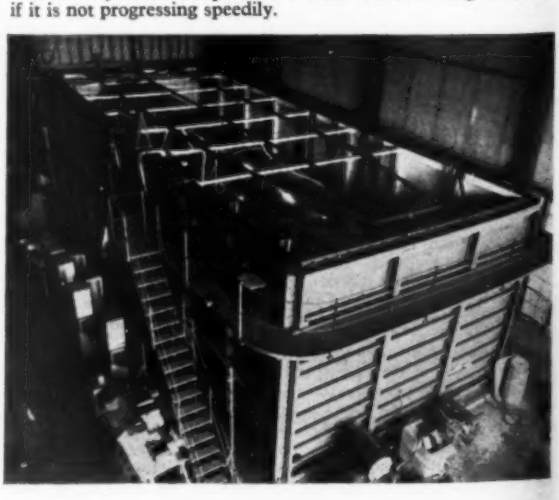
THE future of Britain's supersonic airliner was the subject of a brief statement in the Commons on Monday. No comment is forthcoming from the parties concerned; but the gist of reports is that both groups—the British Aircraft Corporation and Hawker Siddeley—have agreed to contribute one-quarter of the estimated cost, but are unwilling to contribute to any excess—which in a project of this kind could amount to many millions.

In a Written Answer the Minister of Aviation, Mr Duncan Sandys, said:

"As the House knows, the principal airframe and aero-engine groups were asked last year to make a general assessment of the feasibility of developing a supersonic airliner. The Government have examined these reports and are now ready to consider proceeding a further stage. This will involve selecting one of the two airframe groups and one of the two aero-engine groups to pursue the work of detailed design. My department is discussing with the four companies concerned the financial and other terms on which the project might be undertaken. The decision to proceed further will depend partly upon the outcome of these discussions. Assuming that agreement is reached, design contracts will be placed with the chosen companies, which will be asked to explore further with appropriate foreign firms the possibilities of collaboration."

No one has given a firm estimate of the cost of designing, developing and bringing into service a supersonic airliner: the popular figure for a Mach 2.2 design (the "light alloy" design-speed projected by BAC and, it is believed, by Hawker Siddeley) is £150 million. If costs escalate as they have done in the case of practically every previous Ministry-sponsored project, even those with fewer "unknowns," this figure could eventually rise to over £200 million. The Treasury—inevitably cautious as a result of its past experience of the unpredictability of aviation industry development costs—evidently wants to limit supersonic airliner funding—especially as the Chancellor is being pressed also to finance a British space programme, and at a time when there is serious Cabinet concern about the extent of Government spending.

However, Britain's supersonic airliner is not marking time, even if it is not progressing speedily.



Seen here in a new 141ft water tank at Montreal is the front section of a Canadair CL-44 fuselage which has been instrumented for measurement of loads, deflections and stress levels. The tank has a side extension to permit action of the swing tail

AIR COMMERCE . . .

CREDIT WHERE DUE

THE recent announcement of Government support for new types of British airliners spotlights this country's lack of a national aviation marketing organization to help sell the industry's products and—more particularly—the need to be able to offer highly competitive credit facilities. In the words of Mr Reginald Maudling, President of the Board of Trade, in the economic debate in the Commons on July 11: "We must become throughout this country more export minded than we are at present. The increase of exports needed, in relation to the total wealth of the country, is not so big—1 or 2 per cent of the gross national product exported would make all the difference." Mr Maudling also stressed that the need was not so much for a better product as for more vigour in selling.

On the same day the Minister of Aviation announced that the Government had decided in principle to support the D.H.121, Argosy, VC10 and Super VC10; the terms of the contracts were now being worked out. This support will be in addition to orders already placed for these aircraft by BEA, BOAC and Transport Command. Of the two supersonic airliner studies now in hand, the Minister said that these were far advanced, and he hoped to be able to make a further statement before long.

Nobody could accuse the aircraft industry of lacking in export consciousness, for its products have earned more than £1,000m since the war in export revenue. On the commercial side, a restricted home market for new British transport aircraft has made a sustained export drive absolutely necessary; a need which does not have to be underlined by exhortation. A pertinent question is whether Government aid as announced by the Minister is in the most suitable form for the aircraft industry. In particular, is there not a case for Government aid to enable the industry to offer more competitive credit facilities for new transport aircraft?

Once, in the dear, dead days almost beyond recall, airliners could virtually be sold wholly on their combination of technical merits and payload/range capacity. Nowadays it is the ability to offer really competitive credit facilities that is the tool for prising open world markets: the Lockheed Electra's conquest of Australasian markets more than two years ago brought home this point very forcibly. It was all the more surprising that no mention was made, when the Government's plans for aiding promising new civil projects were announced in February, of any possible help to the industry in the matter of enabling it to offer more competitive credit. Yet such Government aid envisages not only the underwriting of tooling costs for new airliners, but financing production of a limited number of the latter beyond those for which firm orders have been placed. What happens if these "on-the-shelf" aircraft remain unsold because foreign manufacturers with better credit terms capture the orders?

A Shrinking Market

Past experience indicates that it can take a long time to sell even modern and highly competitive airliners which have been ordered and cancelled. It was not until December 1959 that the last of 15 extra Viscounts ordered by Capital in July 1956 and later cancelled along with that airline's Comets was finally sold to Philippine Air Lines. The two Boeing 707-139s originally destined for Cubana but now leased to Western Airlines are another example of eventual disposal of unwanted capacity, while airlines like Northeast, National and Pakistan International have met the immediate competitive need for jets not by ordering new ones, but by leasing 707s from TWA and PanAm. And current trends towards co-operation, equipment-leasing and spares pooling will have the effect of reducing the markets for new airliners.

Because there threatens to be a glut of new transports coming off the world's production lines in the nineteen-sixties (unless trends towards lower fares are accelerated) a much more hard-headed commercial approach on the part of the Government as well as the industry will be necessary to beat American, French, Dutch and Russian—and eventually West German and Japanese—competition for airliner orders.

Government thinking in this respect may possibly be too much coloured by the attitudes of seven or eight years ago, when the Viscount, Comet and Britannia were unique and unmatched in their respective categories. It is dangerously complacent to assume that every new British airliner is as desirable to potential foreign customers now as the turbine-powered triumvirate were then, and that all that is required to start the world buying British-because-it-is-best is a small injection of Government aid. For a variety of reasons we were not able to maintain our initial lead in turbine-powered airliners; other nations have since caught up, and there are now a multiplicity of types jostling each other for a share in a market that is much smaller than it was five years ago.

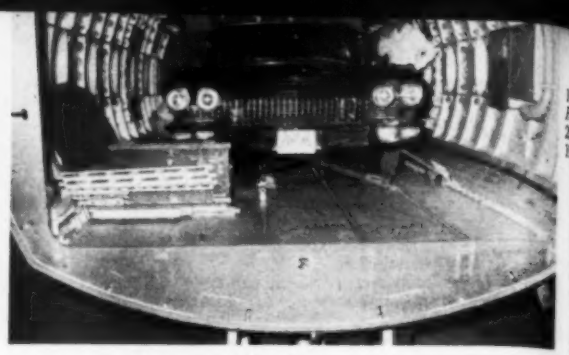
Are we as well equipped as we should be to offer competitive credit facilities? Recent events suggest that the answer is "No." The Middle East Airlines Comet order was very nearly lost—together with the prospect of further Comet sales to Middle Eastern operators—because of Treasury delay in approving BOAC's underwriting of instalments on MEA's four Comet 4Cs. The loss of this order would have once again put MEA's association with BOAC in jeopardy, and MEA's chairman, Sheikh Najib Alamuddin, was forced by the delay to consider leasing Caravelles or Convair 600s. Not only that, but US manufacturers were making the Sheikh offers "so attractive as to be almost irresistible." Among these was an undertaking to buy MEA's seven Viscounts at their original book value, and to extend eight years' credit for new equipment at an interest rate of six per cent. Another proposal was for another operator to run MEA's routes, to pay all costs and to give MEA 12 per cent of the gross revenue over a period of eight years. After this all aircraft, equipment and premises would have become MEA's absolute property. In spite of these temptations the Sheikh preferred Comets, but by no means all airline executives can be expected to maintain such a staunchly pro-British re-equipment philosophy. BOAC had to guarantee MEA's order because this had been asked for by de Havilland; it could only have been guaranteed by the Export Credits Guarantee Department at a further cost of about £100,000 in interest.

National Necessity

Another instance in which it rather looks as if the ECGD has been found wanting is in Olympic's order for three Comet 4Bs, for which BEA is acting as a purchasing agent. Precise details of this arrangement, as related in *Flight* of March 18, were the subject of a question to the Minister by Sir Arthur Vere Harvey on February 1, although Sir Arthur did not succeed in obtaining a satisfactory answer. It is not clear exactly why the ECGD was by-passed in this instance, but the corporations should not have to purchase aircraft for their foreign pool partners. The MEA and Olympic Comet orders underline strongly the need for a national aviation marketing organization similar in purpose, although not necessarily similar in structure, to Russia's Avtoexport, Czechoslovakia's Omnipol, Poland's Motoimport and France's OFEMA (Office Français d'exportation du Matériel Aéronautique) and OGA (Office General de l'Air). The two latter bodies have set up a network of foreign branches to ensure proper exploitation of markets, and in this way orders have been secured for French aircraft in India, Israel and Latin America.

Any equivalent British marketing organization should also set up branches in countries likely to order the industry's products, especially in the Commonwealth, with its multitude of outback operators. Such an organization might also act as an agency for the purchase and disposal of piston-engined equipment traded-in against new aircraft on order. Its branches would be very useful in the newly emerging nations, of Africa particularly, to whom an airline is as much a status symbol as a means of providing transport. This attitude was expressed earlier this year by Mr Krobo Edusei, Ghana's Minister of Transport, when he said that his country's airline "should give special consideration to the political aspect of its activities rather than the commercial side," adding that although new routes to be inaugurated by Ghana Airways may be uneconomic at first, this would be far outweighed by the "imponderable benefits" accruing to Ghana's prestige. But are we not being just as naïve commercially in failing to recognize the need to offer better credit facilities for those who wish to buy British airliners? M. J. H.

There was some friendly rivalry between PanAm and Sabena to be first off Shannon's international jet runway when it opened for daylight use on July 6. PanAm were first off with DC-8 "Jet Clipper Gauntlet" and a Sabena Boeing 707-324 operated the first scheduled 707 service. Round-the-clock operation starts early in August, when radar and runway lighting becomes available



Here (left) is TWA's long-awaited "Glide-Aire" baggage loading system, now being tested on Boeing 707 flights between Los Angeles and New York. It operates on the air-cushion principle (see paragraph below). Right: During AWA Argosy route-proving trials to Beirut, the headquarters of Trans Arabia Airways, the aircraft ferried out a Cadillac belonging to Sheik Abdullah al Mubarak al Sabah, deputy ruler of Kuwait. The airline should receive the first of two Argosies in November

AIR COMMERCE . . .

TWA's BAGGAGE SYSTEM

A BAGGAGE handling system known as "Glide-Aire," developed jointly by the Douglas Aircraft Company and TWA, is now being evaluated on the airline's Boeing 707s. The system depends upon the generation of a low-pressure air cushion between the base of a pre-loaded light-alloy baggage container and the aircraft's floor, which is specially modified. Each container has a capacity of 1,200lb and nine of them—six forward and three aft—can be installed in the baggage holds of a Boeing 707.

At the base of each container is a swivelling "Glide-Aire" pad which discharges low-pressure air through a single orifice. The air is supplied from a compressor on the jeep to which the loading conveyor is mounted and passes to the pads through flexible hoses fitted with quick-disconnect couplings. The conveyors are existing equipment modified to fit the cargo-compartment doors and extended to pick up the containers from the flat dollies on which they are brought up to the aircraft. Modifications to the aircraft consist of a plywood sub-floor fastened to the existing tie-down fittings to distribute the load and longitudinal guides which have been added to the edges of the floor to act as container restraints. They carry loads into the cargo tie-down tracks.

The containers have drop-down sides for quick loading of baggage. After being run out to the aircraft and lifted into the hold on the conveyor, they are manually guided into position and the air hose is disconnected. TWA's best unloading time from engines off until the last container reaches the baggage claim area is so far eight minutes, but with further modification this could, they say, be reduced to six minutes.

FINNAIR TURNS TO JETS

NO airline is being affected so dramatically by the advent of the jet age as the Finnish national carrier, Aero O/Y. In the space of the past few months, acquisition of three Caravelles has doubled the airline's overall capacity. These aircraft are being put on to routes upon which traffic is thin, averaging only twenty passengers on each flight, and upon which frequency is low.

Unfortunately, in their recently published annual report for 1959 the airline makes no reference to the technical and commercial problems raised by the arrival of this Caravelle fleet, but the facts given all point towards the likelihood of Finnair identifying themselves more closely with one of Europe's two groupings of Caravelle operators.

Finnair are no strangers to this problem of capacity threatening to go head of traffic; over the past five years their capacity has doubled while traffic has only gone up by half. Yet they have managed to come through making a marginal profit. The secret of this success appears to lie in high utilization of men and machines; efficient use of staff allows the company to supplement its traffic revenue of 2,671m Finnish marks with a further non-traffic income of 205m marks; while keen scheduling allows the company to achieve an average aircraft utilization of over 2,300hr a year (on a short-haul, semi-Arctic network this is quite remarkable). This degree of utilization is reflected in a unit cost level below 27 pence per c.t.m.—probably the lowest for any airline in Europe or, for that matter, outside North America.

This conservation of resources has been extended to capital. Compared with most airlines in Europe which are happy to turn over their capital only once in a year—and many fail even to do that—Finnair manage to earn annual revenues which are about double the capital value of the company. If Finnair had been able to achieve higher load factors their profits would have led to the accumulation of bountiful reserves to finance the purchase of Caravelles. However, over the past five years their load-factors have consistently stood at about 50 per cent on both domestic and international services. As a result there has been little scope for ploughing earnings back into the business, and the Caravelle programme has had to be financed by a massive addition to issued capital from 60 to 900m marks. Three-quarters of this is to be subscribed by the Finnish government.

Finnair's international network consists essentially of four routes which fan out from Helsinki to Moscow; to Copenhagen, Dusseldorf, Frankfurt and Geneva; to Hamburg, Amsterdam and then London or Paris; and finally to Stockholm. Before the arrival of the Caravelles this network kept six Convair 440s fully occupied. The local routes north of Helsinki are operated almost entirely with a DC-3 fleet numbering ten aircraft. With few of these domestic routes offering enough traffic to support a 48-seater aircraft economically it will be interesting to see what fate is in store for Finnair's Metropolitans.

THERE'S A GARAGE DOWN THERE

THE provision of aviation fuel at suitable roadside filling stations for helicopters "dropping in" unheralded is the subject of talks in progress between the BEA Helicopter Unit, Esso, and Shell Mex-BP. Such facilities would lead to a "notable increase in the use of charter helicopters for business and private travel," said Captain J. A. Cameron, the head of the Helicopter Unit, last week.

Captain Cameron claims that he spends more time arranging refuelling for his charter helicopters than he does arranging the charters themselves. The need to fly to licensed aerodromes for refuelling entails much unnecessary flying, and higher costs to the charterers.

Business is booming for BEA'S helicopter fleet of two Whirlwinds, one Sycamore, one Bell 47B and one Bell 47J. The 47B (now the oldest Bell helicopter flying in the world) is engaged on potato blight control in Scotland, and the other four aircraft are on charter flights. "There has been a very healthy increase in charters," says Capt Cameron, "and we are turning work away. The last thing we need to do at this time is to canvass for charters." BEA is contemplating an increase in its light helicopter fleet, despite the seasonal nature of charter business.

Footnote. Commenting on a report (unconfirmed by Westland) in the *Daily Express* last Tuesday that the Fairey Rotodyne may not be developed as a civil transport because it is too noisy, and that work may proceed on the projected 50-passenger Bristol 194, a BEA spokesman said: "We are very interested in the Bristol 194. It promises on paper to be directly competitive with the Rotodyne, and much quieter."

Receiving the Lawrence D. Bell award for over ten years' pioneering work on helicopters is Mr M. D. N. Wyatt, chairman of British United Airways. With him are Mr J. E. Harper (right), formerly managing director of Fison-Airwork and now with British United's helicopter division, and Gen John Schweizer (left) who made the presentation

AVRO 748 FLIGHT-TEST REPORT

JUST on 60 hours' flying has been completed by the Avro 748 in the first four weeks of its flying life. The average duration of each flight, in a month that the Meteorological Office has observed to be "one of the wettest Julys on record," has been about 2hr 50min. Over 200 stalls have been carried out and a preliminary flight assessment has been made by Air Registration Board test pilots. Avro have applied for a Special Category Certificate of Airworthiness and this should be granted on completion of a full inspection and minor modification programme that started on July 24 and should be completed, in time for the SBAC show, towards the end of August. Full certification is expected to be achieved by the original target date of April 1961, by which time 500 or 600hr should have been flown by the first and second aircraft. The second 748 should fly in December; it will be used for the route proving to be undertaken in conjunction with Skyways, who expect to operate the aircraft next summer.

Such fast progress is perhaps best measured against what was the anticipated schedule of 7hr test flying a week; that this has been more than doubled testifies to the mechanical reliability of the first 748 and to the soundness of the design. While this is not to say that development problems do not exist, in the first month the aircraft has been flown at its maximum weight of 35,100lb, up to an EAS of 270kt; to heights of 26,000ft (pressurization and de-icing boots have functioned from the first flight) and to within 80 per cent of the maximum design-factor speeds with undercarriage and flaps down. Speeds reached have been: undercarriage down, 140kt; take-off flap, 140kt; landing flap, 120kt. Four water-ballast tanks are installed fore-and-aft in the fuselage and these enable the c.g. to be traversed through its full 14in travel in about 3min. Handling at all c.g. positions has been checked including at the extended aft limit.

In individual tests, the Avro test pilot team of J. G. Harrison (chief test pilot), Colin Allan and Tony Blackman have checked aileron, elevator and rudder balance; stalls in all configurations of flap, undercarriage, power and c.g. (there are a total of 16 different combinations); position error has been measured by aneroid and trailing static methods; longitudinal trim curves have been plotted on forward and aft c.g., power on and off and flaps up or clean; trim changes with power, speed and flap have been examined; and so has stick force per g. Other test flying has covered minimum control speeds, engine out; roll rates; lateral stability and trim changes; and climb performance in four configurations of power, undercarriage and flap settings. A preliminary look has been taken at level speed and take-off and landing performance and the undercarriage has been allowed to free-fall following mechanical release of the up locks. The system is said to work provided that 120kt airspeed is maintained.

Sixty hours airborne in 20 flights is the Avro 748's record in the four weeks since its first flight on June 24

How has the aeroplane handled throughout this first extensive examination of its flying characteristics? According to J. G. Harrison, the 748 rides well and is virtually buffet-free. A small strake that surrounded the forward part of each lower nacelle—included as a result of wind tunnel tests—was removed to check its effect and will not be replaced. On the other hand, aerodynamic stall warning is slight and a breaker strip will be added to the inboard leading edge of each wing to improve it. The pilots say that "We are in no doubt about control powers but we have further work to do on balancing"; during a recent *Flight* visit to Avro's aerodrome at Woodford strips were being riveted to the aileron trailing edges to assess just what degree of balance is needed. At the moment the ailerons are light at high speed and rather heavy low down. Some of the stall requirements written into BCARs are not yet being met. One of the most difficult is a handling requirement which says—in effect—that in a stall with flaps fully down, c.g. aft and power on for level flight, a wing must not drop more than 20° with the stick pulled fully back and held. A systematic attack to meet all BCAR requirements is the next stage of the flight programme.

Rapid progress with the 748 flight programme is due in part to care in planning installations in the aircraft. Three ciné recorders are installed in the soundproofed but untrimmed fuselage, one aft for position error measurements, and two others at the flight observer's positions in the forward fuselage. A navigator is a permanent member of the crew and the installation of Gee for position fixing has enabled the pilots largely to exclude navigational procedures and worries from their test flying.

Examination of the cockpit confirms the impression of neatness and good layout evident in the mock-up exhibited at the SBAC show last year; advice on planning it was received from airlines, from the BALPA Cockpit Committee and from ARB. Nevertheless a number of changes are to be made on the second aircraft. The electrics on the three roof panels, for example, will be grouped to port and starboard leaving the centre panel available for navaids. The control console is also to be modified to make room for Decca. Auxiliary engine controls, now in a forward position on the console, will be moved aft behind the power levers and the Decca log will take their place. No arrangements have yet been made for equipping the 748 with both Decca and with a scope for weather radar. All subsequent aircraft are to have an eyebrow window on each side of the cockpit roof to give the pilots better visibility in turns. Undercarriage aural warning is to be fitted in place of the wagging flag a.s.i. installed at present. This will then be the second aural system; already installed is a horn which blows 5sec after the nosewheel touches the ground if the flight fine-pitch stop has not been withdrawn. Other minor cockpit changes, some of which will be incorporated during the present inspection, will be to reposition the parking brake and friction damper and to equip the aircraft with auto-synchronization and with gust locks.

Some more information is now available about the production of aircraft in India. Already assembled at Kanpur is a complete set of replica jigs and the first set of parts from Avro's production jigs has now been delivered. The first Indian Avro 748—a Series 1 (Dart RDa.6s)—is being entirely assembled by the Indian Ministry of Defence factory from detail parts sent out from Manchester, and Avro engineers are assisting.

Eventually Avro 748s for the Indian Air Force will be produced in Series 2 form (Dart RDa.7s) and the IAF are expected to take the Avro 748M (Avro 757) military variant. Another Avro project still under consideration is the high-wing 758, more specifically a military design equipped with rear loading and for supply dropping. A swing-tail version has been studied.

A number of changes are being made to the original layout of the cockpit as shown here. Among these are re-arrangement of the console to make room for a Decca flight log, a revised coaming with a "horizontal plane of reference," revision of the overhead panels and the addition of eyebrow windows

AIR COMMERCE . . .

GET-YOU-HOME CO-OPERATIVE

OUTSTATION parts provisioning for BOAC's Boeing 707s, according to corporation figures, stands the airline in at well under £200,000 per station. This is a benefit of co-operation in an eight-member parts pool without which, it is estimated, the corporation's holding would be increased to £320,000 per route station and 15 of them would have to be provisioned instead of six. BOAC's responsibility now extends to Goose Bay, Hong Kong, Keflavik, Prestwick, Shannon, Montreal and Idlewild.

When the first discussions with four other Boeing 707 operators or potential operators (TWA, PanAm, Qantas and Air France) were held in May last year it was decided that, initially, specified parts and facilities would be held at selected stations for use by members of the pool. The object was not to provide parts for permanent use or for maintenance but to make available parts covered by the scheme for getting an aircraft back to its home base. Subsequently parts have to be returned to their owners within 14 days, and if a spare is damaged the onus is upon the borrowing airline to repair it. For this self-service, the parts-pool airlines (of which there are now eight, Air-India, Sabena and Lufthansa having joined later) charge each other an "availability charge" and a replacement fee. The former is calculated on a formula based on the number of spares the members wish to have available at any of the 23 stations and alternates which are now covered.

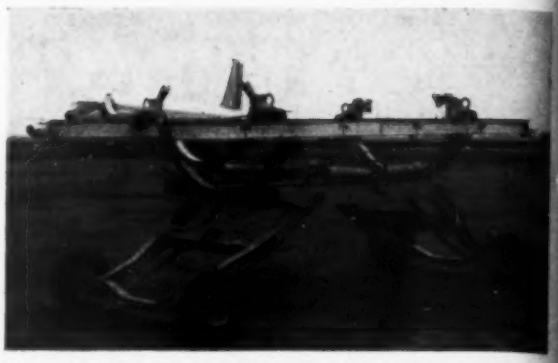
Administration of the pool is the responsibility of chairmen appointed in alphabetical order from among the eight airlines. His job is to co-ordinate day-to-day operation and to convene meetings as necessary. One month before his term ends there will be a special meeting at which spares lists are reviewed item by item, problems discussed and applications for membership considered (Pakistan International Airlines may be the next to join). This season's chairman is K. W. Forsythe, BOAC manager, line maintenance.

FLYING THE SIMULETTE

THE Link division of General Precision Inc, New York, has designed for multi-jet flight training an inexpensive new simulator known as the "Simulette." It is a standard model, not representative of any particular aircraft, but intended to be typical of a range of four-engined swept-wing jet transports.

Although based broadly on the ME-1 Link trainer for the USAF Cessna T-37A, the Simulette characteristic is that of a big jet, and it represents jet-transport behaviour under similar conditions of aircraft attitude, power, all-up weight, c.g., "dirty" or "clean" configuration, or in rough air. "Maximum weight" can be varied between 195,000lb and 280,000lb, service ceiling is 40,000ft, rate of climb is up to 6,000ft/min and there is coupled pitch and roll—the pilot's seat can be subjected to ±0.6g.

Where the Simulette differs most from conventional jet simulators is that it is much smaller. Only two seats are provided, one for the pupil pilot and another for the instructor. Emergency procedures and systems operation of a particular type must still be taught in a representative simulator (or in the air) but the new Link machine enables pilots to be trained to handle Dutch roll, swept-wing techniques and jet instrument approaches. It is intended particularly for the smaller, perhaps less affluent jet operators. The price is about $225,000 (£80,000) and this is said to be about a fifth of the cost of a typical full-scale jet-transport simulator. This claim obviously relates to the US price of big-jet simulators (i.e., about £400,000), because the British Air Trainers Link Division of General Precision Systems builds them for £100,000 to £130,000.



This positioning trolley for P & W JT4 engines has been developed by Sabena for use with their Boeing 707 fleet. They are manufacturing 28—12 for themselves and the remainder for Pan-Am, TWA, Alitalia, Air France and TAI

BREVITIES

Swissair are using a DC-8 converted to all-cargo configuration to fly food into the Congo. Refugees are being carried on return trips.

Ghana Airways aircraft were last week diverted to carrying troops into the Congo and all international and regional flights were temporarily suspended.

RAE visual glide path (red-and-white light) indicators—as installed at London Airport—have been recommended by the FAA's Bureau of Research and Development as a US national standard. They are being evaluated at the National Aviation Facilities Experimental Center at Atlantic City.

Laurence W. Hopkins has been appointed manager, scheduled services, of Overseas Aviation (CI). This appointment has been made so that the company has permanent representation at the hearings of the ATAC and the Air Transport Licensing Board. Overseas say that they are "progressively seeking entry into scheduled service operations"

Following some months of tests, Sud-Aviation have reduced the guaranteed landing distance of the Caravelle ("by recent FAA definition") to 4,800ft at a landing weight of 86,000lb.

The US Federal Aviation Agency may purchase a Lockheed Electra, Convair 880 and Boeing 720. They would be used in part for the training of FAA in-flight inspectors.

Varig confirm that they are the operators (see "Borrow my Boeing," *Flight*, July 22) whose Boeing 707-420 was offered for lease in *Aircraft Exchange*. A telegram to *Flight* from Ruben M. Berta, Varig's president, says that "A 707 will be available for occasional charter flights out of New York."

The MoA have recently issued *Civil Aviation Information Circulars* 71/1960, 72/1960 and 73/1960. They refer respectively to the publication of a new series of aeronautical charts; scheduled Volmet broadcasts from SATCC; and a correction to Circular 57/1960 dealing with the Air Navigation Order 1960.

As from August 3, Lufthansa are to operate a weekly Constellation Super-G service from Hamburg to Dhahran, Saudi Arabia.

Aircraft parts suppliers who are creditors of Transocean Airlines have demanded that the operator be declared an involuntary bankrupt.

Western Airlines are to take up their option on a fourth Boeing 720B. Delivery will be next year at a price of $4.8m.

IATA's clearing house in London reports a 33 per cent increase in airline transactions during the first quarter of the year. Part of this is the result of a re-arrangement of clearing procedures.

Central African Airways made a trading profit of £70,000 in the financial year which ended in June. This contrasts with CAA's £169,000 loss in the previous year.

Ansett-ANA are studying the possibilities of a helicopter service over the 121-mile route between Gympie and Brisbane; another proposal is for them to operate services from Brisbane city-centre to the airport.

At the start of a descent from over 30,000ft into Shannon on July 20 a PanAm DC-8 suffered what was described as a "shattered" windscreen. There were 70 passengers on board, but they remained unaware of the incident until their arrival at Shannon.

Negotiations in Bonn on the rights of SAS to uplift passengers and freight at West German airports are in danger of breaking down. It is argued by Germany that SAS rights were acquired under abnormal post-war conditions and they are now hampering the growth of Lufthansa.

Extensions to Dublin Airport's 17/35 runway, which bring the length to 6,000ft, should be complete by the end of the month. When this runway is again in full use, a start will be made on extending the main instrument runway, 06/24, to 7,000ft.

It has been announced by Riddle that the airline is to form a wholly owned subsidiary company to fund the purchase of its Argosies, engines and spares. "Trust loans," according to Riddle's president, Robert L. Hewitt, "will be secured from American and British financial interests."

Zantop Air Transport of Detroit is negotiating the purchase of five Lockheed C-130Bs to fulfill a $5m Logair contract. The aircraft would cost $2.8m each and the total order would be worth about $16m. Zantop hope to place the first aircraft in service on March 31 next year.

Replying to Lord Brabazon's charge (see *Flight* last week) that "a Canadian airline" was using JP4, the Parliamentary Secretary to the Canadian Minister of Transport, Mr C. W. Hodgson, said that the fuel would not be used if it were considered to be unsafe. But it was widely used, and this was a matter of airline judgment.